AD-A073 471 DEFENSE ATOMIC SUPPORT AGENCY WASHINGTON DC F/G 6/18

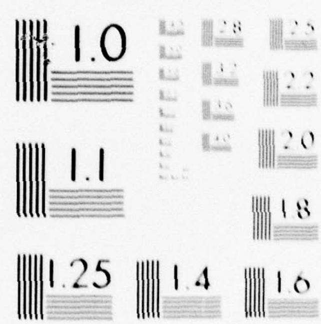
OPERATION USPHOT-KNOTHOLE, NEVADA PROVING GROUNDS, MARCH - JUNE--ETC(U)

JUN 53 T D COLLISON

UNCLASSIFIED DASA-WT-817 NL

1 OF 2

AD A073471



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

[redacted]

#29 Rpld 1270179

WT-817

Copy No. 187 A

AD A073471

UNCLASSIFIED

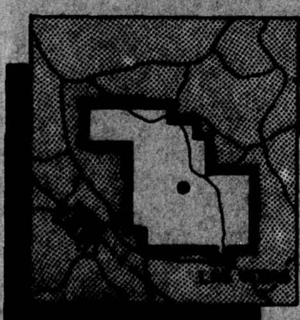
Operation UPSHOT-KNOTHOLE

NEVADA PROVING GROUNDS

March - June 1953

RADIOLOGICAL SAFETY OPERATION

Classification (Cancelled) (Changed to UNCLASSIFIED
By Authority of Chief AFSWP 11/14/57
By R. J........ Date OCT 1 1958



[redacted]

Statement A
Approved for public release;
Distribution unlimited.

FIELD COMMAND, ARMED FORCES SPECIAL WEAPONS PROJECT
ALBUQUERQUE, NEW MEXICO

Available OTS

79 08 21 044

[redacted]

1445

UNCLASSIFIED

[redacted]

UNCLASSIFIED

WT-817

This document consists of 172 pages

No. 197 of 235 copies, Series A

Report to the Test Director

RADIOLOGICAL SAFETY OPERATION

By

Tom D. Collison
Lieutenant Colonel, U. S. Army

see card (cover)

Field Command
Armed Forces Special Weapons Project
Albuquerque, New Mexico
June 1953

[redacted]

Statement A
Approved for public release;
Distribution unlimited.

UNCLASSIFIED

[redacted]

ACKNOWLEDGMENTS

The advice and assistance of Col Clinton S. Maupin, Medical Corps, Field Command, AFSWP, as Radiological Safety Staff Officer, contributed greatly to the success of the radiological safety mission during the Upshot-Knothole continental atomic test series reported herein.

[redacted]

CONTENTS

[redacted]

Page

[redacted]

UNCLASSIFIED

LIST OF INCLOSURES

[redacted]

UNCLASSIFIED

Page

[redacted]

[redacted]

Chapter 1

INTRODUCTION

1.1 GENERAL

1.1.1 The Atomic Energy Commission, in addition to its other functions, has been given the responsibility of controlling the health hazard produced by radioactivity in all phases of the Atomic Energy Program. Thus, when atomic devices are tested at the Nevada Proving Grounds, the AEC must take action to provide radiological control and protection for the personnel involved in such tests as well as protection for residents located in the nearby vicinity and elsewhere in the United States.

1.1.2 In order to carry out the requirement outlined above, the AEC requested that the DOD furnish an organization capable of providing the necessary radiological control and presenting the necessary data to evaluate the radiological hazards involved.

1.2 HISTORY

1.2.1 Operation Buster-Jangle, fall 1951, saw the first military participation in the continental tests being held in Nevada; prior to this time only one test had been conducted in Nevada, Operation Ranger. The Rad-Safe organization for Buster-Jangle was organized and manned by H-Division of LASL and was augmented by a group of military personnel originally scheduled for the Windstorm operation, which had been canceled. This group, consisting of approximately 30 officers from all three services, assisted in the Rad-Safe portion of the operation. At the conclusion of this operation, the Chief, Chemical Corps, was given the responsibility of furnishing the trained Rad-Safe personnel for the following operation, Tumbler-Snapper, spring 1952. The Tumbler-Snapper operation was the first continental test in which a full scale military Rad-Safe organization was used. The 216th Chemical Service Company from Rocky Mountain Arsenal formed the greater portion of this organization. The 216th was augmented by personnel, in small numbers, from the Signal Corps, other Chemical Service Companies, and the Air Force and Navy.

1.2.2 Upon completion of the Tumbler-Snapper operation, plans for a new type of organization to facilitate handling of this type of operation were formulated. A special Rad-Safe Support Unit was to be formed for Operation Upshot-Knothole. This unit was to be activated and manned at the Training Center, Fort McClellan, Alabama, and would consist mostly of Chemical Corps personnel who would be augmented by 10 personnel from each of the other two services, Air Force and Navy. In addition to the above personnel, an Off-Site Rad-Safe group was to be organized to consist of civilian Public Health Service personnel, with augmentation by military personnel from the Rad-Safe Support Unit. All the above were to be under the command of an officer appointed by AFSWP.

1.3 ORGANIZATION OF REPORT

1.3.1 This report itself is divided into separate chapters for each shot with the period running from D-1 of one shot to D-1 of the following shot. Each chapter has a separate section for On-Site Operations, Off-Site Operations, Air Participation, Logistics and Supply, and General Comments. Chapter 13 contains an account of the roll-up of the Rad-Safe Unit and miscellaneous items that were not covered in the previous chapters. Chapter 14 contains a general account of the operation and function of the Rad-Safe Unit and the major sections.

1.4 ORGANIZATION AND PERSONNEL OF RAD-SAFE UNIT

1.4.1 The functional organization of the Rad-Safe Unit for Operation Upshot-Knothole, the missions of the sections of the unit, radiological safety regulations, and permissible contamination levels are shown in the Rad-Safe Unit Operation Order, Incl. 1. The omitted annexes, showing the procedure of operation of the sections, can be found in WT-702(REF.).

1.4.2 A total of 264 persons was assigned to the Rad-Safe Unit during the operation, and 105 participated in all shots. The majority of the personnel were provided by the Chemical Corps Training Command with the temporary assignment to Mercury of the 9778 TSU as the Rad-Safe Support Unit, with an approximate strength of 26 officers and 144 enlisted men. Five Navy officers and 5 Navy enlisted men, 5 Air Force officers and 13 airmen were on TDY to Mercury, to augment the unit. The Off-Site group, headed by a LASL civilian, consisted of 15 PHS officers, 2 LASL civilians, 1 Chemical Corps officer, and approximately 10 enlisted personnel from the support unit and augmentation personnel. The instrument repair section of On-Site Operations was supported by personnel of Project 6.8.

1.4.3 All the above personnel functioned as an integrated unit under the direction of the Head of the Rad-Safe Branch, P and O Division, DWET, who was designated as the Rad-Safe Officer, for Test Director, at the Nevada Proving Grounds.

1.4.4 As the burnout problem for monitors for this operation would be greater than that for previous operations, arrangements were made with the Chemical Corps Training Center to keep a reserve group of monitors, approximately 20, at Fort McClellan. These would be available to the Rad-Safe Unit at any time during the operation. In addition to this, arrangements were made for four members of the Passive Defense Group at Sandia Base for use during the latter half of the operation. These four would generally be used as monitors and would be given as much experience as possible during this phase of the operation.

1.5 AIR SUPPORT

1.5.1 Air support for the Rad-Safe Unit was provided by the 4925th Test Group (Atomic) of AFSWC. It consisted of two B-29's and one B-25 used for cloud tracking, one C-47 and two L-20's used for the low level terrain survey, and two helicopters to be used for on-site surveys. All the above planes were controlled by the Control Officer of the Rad-Safe Unit through the Air Control Officer of the 4925th Test Group (Atomic).

1.6 SUPPLIES

1.6.1 All supplies needed for the operation, which were not already on hand from previous operations, were purchased by the AEC. Many critical items did not arrive until just prior to the first shot; and, although this caused some difficulty, everything except communications checked out satisfactorily before the first shot. A check on communications was not possible as the vehicles arrived late and some radios were not installed until the day before shot time. The radios installed in military vehicles were not satisfactory. The new military vehicles had a 24-volt ignition system. The radios operated on a 6-volt system. This problem was not

satisfactorily solved by the Las Vegas Field Office prior to the first shot. In addition, the repeater station could not be relied upon. A dry run, scheduled at 0500 two days before the first shot, was completed without communications because the repeater station was not functioning that morning.

1.6.2 The 35,000 film badges for the operation were arranged for through H-Division, LASL, and the Division of Biology and Medicine. They were made by Du Pont and consisted of a 502 and a 606 film, the 502 being the more sensitive. The films were to be covered by a lead shield on each side 0.72 mm thick and ½ in. wide by 1 in. long. They were received from the manufacturer with ½ in. lead coverage on one side and 1 in. of lead on the other. Arrangements were made through the Purchasing Department of LASL to have a portion of them returned to Du Pont for correction. So as not to delay the operation, this was done in increments of 5,000 badges. In all, 28,000 were corrected.

1.7 PROGRAM MONITORS

1.7.1 Project requirements were to be met by appointing an officer monitor for each program. This program monitor would generally coordinate the needs of his particular program, would monitor for that program whenever possible, and would arrange for the additional monitors needed for the program. Program monitors would attend all rehearsals of their programs. A letter, Incl. 2, was sent to each program, project, and contractor, to introduce the Rad-Safe Unit and the program monitor and to briefly introduce the Rad-Safe requirements to test personnel.

1.8 CALIBRATION OF INSTRUMENTS AND DOSIMETERS

1.8.1 The instrument repair section mechanically calibrated all survey instruments between each shot period. Instruments were assigned to active monitors by the week. Monitors were then required to check calibration of their individual instrument on the calibration range before each monitoring assignment. Frequent checks were made by the On-Site Operations Officer to see that the calibration checks were thorough. A 1 curie Co^{60} source obtained from Oak Ridge was calibrated against sources at Los Alamos by the officer in charge of the Dosimetry and Records Section, to be used as a source for calibration of the survey meters.

1.8.2 All dosimeters were calibrated against a known Co^{60} source. Those pocket dosimeters not meeting a 10 per cent tolerance or considered unsatisfactory for another reason were segregated for return to the manufacturer. Calibration curves were run on film badges to be used during the operation both at the Nevada Proving Grounds and at Los Alamos. The two curves checked excellently.

[redacted]

UNCLASSIFIED

Inclosure 1

RADIOLOGICAL SAFETY OPERATION ORDER NO. 1-53 (UPSHOT-KNOTHOLE)

Table of Contents

[redacted]

UNCLASSIFIED

RADIOLOGICAL SAFETY OPERATION ORDER NO. 1-53 (UPSHOT/KNOTHOLE)

1. Purpose

The purpose of this radiological safety plan is to provide for the protection of all persons at or within a radius of 200 miles of the Nevada Proving Grounds, for the maintenance of operational efficiency of personnel involved in Operation Upshot/Knothole in the presence of radiological hazards, and for the collection and dissemination of radiological safety information.

2. Organization and Personnel

a. The Radiological Safety Organization is shown in Annex A to this order.

b. Personnel of the Rad-Safe Organization will consist of a Rad-Safe Support Unit organized and trained by the Chemical Corps Training Command. This unit will be supported by LASL civilians, U. S. Public Health Service Officers, and selected Armed Forces Advisory personnel.

3. Responsibilities

a. The Radiological Safety Officer is responsible for carrying out the Rad-Safe policies of the Test Director. He is responsible for keeping the Test Director informed of the radiological status at the Nevada Proving Grounds and within a radius of 200 miles of the target areas. To fulfill these responsibilities he will supervise and coordinate all activities of the Rad-Safe Organization. He is responsible for furnishing all ground monitoring services required for scientific programs and for radiological safety in areas within a radius of 200 miles from NPG. He is responsible for providing the Test Director with up-to-date situation charts and maps showing on-site and off-site data and with plotting data provided by cloud tracking and terrain survey aircraft. He is responsible for coordination with the Indian Springs AFB Rad-Safe Officer in handling certain Rad-Safe requirements.

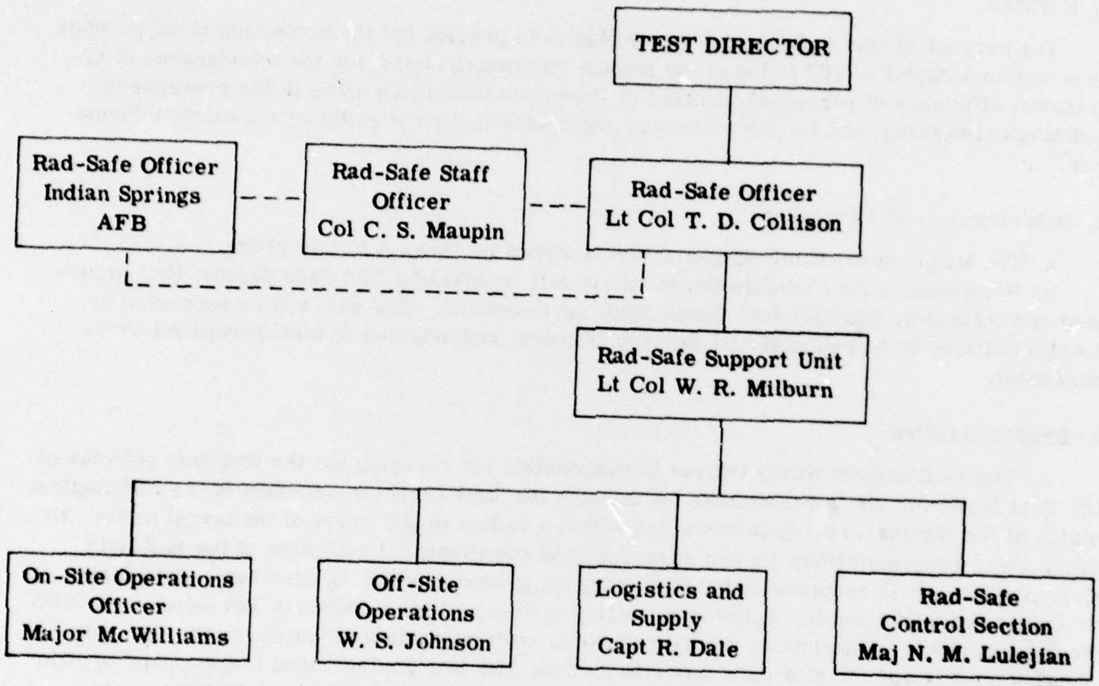
b. The Rad-Safe Staff Officer will act as advisor to the Test Director on general medical matters and on all radiological safety matters affecting health and welfare of personnel at NPG or having implications external to NPG. He will work closely with the Rad-Safe Officer, and is to advise on technical medical matters. He will act as liaison officer for and advisor to the Test Director in connection with radiological safety of aircraft crews, sample handling personnel, and plane decontamination at Indian Springs.

TOM D. COLLISON
Lt Col, Cml C (Arty)
Rad-Safe Officer, NPG

[redacted]

UNCLASSIFIED

Annex A, Organization Chart



——, Supervisory responsibility. -----, liaison and advisory.

Annex B, Radiological Safety Regulations

1. The total permissible dose for personnel involved in this operation is 3.9 roentgens, gamma only, unless reduced by the Test Director because of previous or anticipated future exposure. No limitation is placed on the rate of accumulation of the total dose.

2. The arrival and proposed use of radioactive sources at Nevada Proving Grounds will be reported to the Radiological Safety Officer.

3. All samples of radioactive materials which are removed from the test site will be packaged and loaded so as to reduce radiation to a minimum and will be cleared by the Rad-Safe On-Site Operations Officer.

4. Contaminated containers for radioactive materials and equipment, other than those couriered, leaving the test site will be decontaminated, packaged, monitored, and labeled in such a manner as to satisfy the requirements of the Interstate Commerce Commission for transportation of same. This information will be furnished by the Rad-Safe Officer upon request.

5. All samples of radioactive material which are couriered in aircraft will be packaged and loaded so as to reduce radiation to a minimum. The Rad-Safe Officer at Indian Springs AFB will have a survey made of the package to determine if adequate precautions have been taken. The following criteria will determine space and packaging requirements:

a. Prior exposure of aircraft and courier personnel.

b. Anticipated future exposures on trip.

c. Length of time of exposure on trip.

d. In all cases crew members will be limited to dosage rates of less than 20 mr/hr.

6. Each area in which a detonation takes place will be considered contaminated until cleared for operations by the Test Director.

7. Entry to and exit from contaminated areas will be via Rad-Safe check points only.

8. Contaminated areas of intensities greater than 100 mr/hr will be delineated as such; personnel entering these areas must be accompanied by a monitor and will be subject to clearances by the On-Site Rad-Safe Operations Officer. Rad-Safe clothing and equipment will be issued to the personnel.

9. Areas of intensities less than 100 mr/hr and greater than 10 mr/hr will be controlled areas; personnel entering these areas will be subject to clearance by the On-Site Rad-Safe Operations Officer. Monitors are not required for entry into these controlled areas.

10. Areas of intensities less than 10 mr/hr are unrestricted from a Rad-Safe standpoint.

11. Rad-Safe monitors assigned to individuals or groups working in contaminated areas, or with contaminated equipment during recovery operations will act in an advisory capacity to keep the recovery party leader informed of radiation intensities at all times. The recovery party leader is expected to accept this advice and act accordingly. It is the responsibility of both the leader and the members of the recovery party to adhere to the limits established in these regulations.

12. Film badges, dosimeters, and protective clothing (coveralls, booties, caps, gloves, dust respirators, etc.) as deemed necessary will be issued to personnel entering contaminated areas by Rad-Safe Supply in the Rad-Safe Building.

13. When eating or smoking in any contaminated area, sensible sanitary precautions will be taken.

14. Prior to each shot a schedule of events for the first day after the shot will be published by the Test Director. This schedule will be followed explicitly for entry times until such time as the area is declared clear.

15. All projects will submit as soon as possible, and at least 24 hours prior to entry time, to the On-Site Operations Officer, a list showing personnel by full name, project, work area, estimated duration of stay, and desired time of entry. The On-Site Operations Officer will use this information in providing film badges, dosimeters, and clothing, and in assigning the necessary monitors.

[redacted]

UNCLASSIFIED

16. *There will be no change of itinerary or area to be covered after entry into a controlled or contaminated area without authorization from the On-Site Rad-Safe Operations Officer.*

17. All vehicles used in contaminated areas will be checked through the vehicle decontamination section before return to Camp Mercury or re-entry into contaminated areas. Users of privately-owned or AEC rented vehicles are advised that contaminated vehicles will be held at the decontamination station until decontamination is completed.

18. All southbound vehicles will be monitored at the junction of the main road and the access road to the Rad-Safe Building. Clearance through this monitor station is mandatory prior to departure for Camp Mercury. (After completion of tests in Yucca Flat, a station will be placed in a corresponding point in the Frenchman Flat area.)

19. Current radiological situation maps of the test areas will be maintained in the briefing room of the Rad-Safe Building, in the Rad-Safe Control Office in Building No. 1 at the CP, and in the orderly room at the Rad-Safe Support Unit, Building No. 200.

20. Current air and surface radexes and radiological situation maps of peripheral areas will be maintained in the Rad-Safe Control Office in Building No. 1, CP.

21. All personnel within viewing distance of an atomic detonation who are not supplied with protective goggles will turn away from the detonation point and close or cover their eyes during the time of burst.

TOM D. COLLISON
Lt Col, Cml C (Arty)
Rad-Safe Officer, NPG

Annex C, Permissible Contamination Levels

1. The contamination levels listed hereon are to be regarded as advisory limits for control of contamination under average conditions.

2. All readings of surface contamination are to be made with side window type geiger counters, with tube walls not substantially in excess of 30 mg/cm square with shield open. The surface of the probe should be held one (1) inch to two (2) inches from the surface that is under observation unless otherwise specified.

3. Personnel and clothing tolerances are as follows:

a. Skin readings should not be in excess of 1 mr/hr. Complete decontamination by bathing is to be attempted.

b. Underclothing and body equipment, such as the internal surfaces of respirators, should be reduced to 2 mr/hr.

c. Outer clothing should be reduced to 7 mr/hr.

4. The interior surfaces and occupied sections of aircraft and vehicles should be reduced to 7 mr/hr. The outside surfaces of vehicles should be reduced to less than 7 mr/hr gamma only at five (5) or six (6) inches from the surface.

5. In air and water the following continuous levels of radioisotope are considered safe:

	Beta or gamma emitter	Long-lived alpha emitters
Water	10^{-7} μc/cc	10^{-7} μc/cc
Air	10^{-9} μc/cc	5×10^{-12} μc/cc

[redacted]

In air for any 24-hr period after a shot, 10^{-4} $\mu c/cc$, of which particles less than 5μ shall not exceed 10^{-6} $\mu c/cc$.

TOM D. COLLISON
Lt Col, Cml C (Arty)
Rad-Safe Officer, NPG

Annex D, Responsibilities of Subsections

1. The missions of the support elements of the Rad-Safe Unit are listed hereon.
2. The Rad-Safe Support Unit Commanding Officer:
   a. Will be responsible to the Rad-Safe Officer, Nevada Proving Grounds for:
      (1) The accomplishment of the missions assigned to the subsections of the Rad-Safe Support Unit.
      (2) Maintaining the Rad-Safe Support Unit at a state of maximum effectiveness for requirements at the Nevada Proving Grounds.
      (3) Assigning of his personnel to various sections and their training and education preparatory for their assignments.
      (4) Necessary inspections, musters, and inventories of equipment to insure readiness to carry out assigned missions.
      (5) Requiring that records, relative to personnel, material, and operations are maintained, the consolidation of all journals and recommended changes to SOP's and section procedures.
      (6) The operational administration pertaining to the Radiological Safety Unit.
      (7) Upon the completion of the operation he will submit a complete operations report with recommendations for future organization or changes in his present organization. This recommendation will include a complete table of distribution with a view toward the establishment of a Rad-Safe Unit for the Nevada Proving Grounds that will be able to fill all Rad-Safe requirements exclusive of Desert Rock and Indian Springs Air Force Base.
   b. He will generally be responsible as a Unit Commander for:
      (1) Administration, pay, housing, and recreational facilities for personnel in his command.
      (2) Promoting and preserving morale, state of health, physical fitness, and the welfare of his command, and seeing that appropriate recognition is made of noteworthy performance.
      (3) Appropriate disciplinary control of personnel within his command, including recommendations for courts and boards.
      (4) In case of accident or death of service personnel assigned to the provisional unit, he will comply with required procedures and regulations.
3. Off-Site Operations Officer: The Off-Site Operations Officer will be responsible for:
   a. Off-Site personnel, Off-Site surveys, air sampling, and a counting room.
   b. The Off-Site radiological situation maps in the Rad-Safe Control Room, and through it he will keep the Control Officer informed of the general off-site picture.
   c. Directing any survey required by low level liaison planes or helicopters.
   d. An area of responsibility generally including the area within a 200-mile radius of the Nevada Proving Grounds, with particular consideration for inhabited areas.
   e. Maintaining a journal of each day's activities and maintaining a record of the size, shape, and duration of the fall-out pattern.
   f. Making and recording particle size measurements, decay characteristics, and absorption data on the beta component of gross fission products, and determining, where possible, the specific activity per particle.

[redacted]

4. On-Site Operations Officer: The On-Site Operations Officer will be responsible for:

a. All activities and personnel of On-Site operations including:

(1) Initial surveys.

(2) Project monitors.

(3) Briefing of monitor and project personnel.

(4) Vehicle and equipment decontamination.

(5) Records and film badges to include the maintenance of adequate personnel records to denote total dosage received by each individual.

(6) Personnel decontamination.

b. Consulting the Rad-Safe Officer as to each day's requirement.

c. Consulting Scientific Program Directors and J-3 as to requirements for the following day, while recovery and re-entry programs are in effect.

d. Posting a schedule of operations for the following day on the On-Site operations center bulletin board.

e. Briefing responsible officers and senior monitors in his section as to the situation for the day and recommending safety requirements for parties entering contaminated areas.

f. Maintaining a log or journal which shall describe briefly in chronological order all events of importance to his section.

g. Supervising the assignment and scheduling of program monitors and project monitors, including those necessary for construction purposes in contaminated areas.

h. Establishing vehicular controls when necessary.

i. Maintaining an On-Site radiological situation map, where he will delineate and post the 10 mr/hr and 100 mr/hr, 1 r/hr and 10 r/hr isointensity lines in the target area.

j. Controlling entry into contaminated areas and making recommendations for non-entry, limited access, or full access areas, and prescribing as required, monitors, film badges, and Rad-Safe clothing and equipment to be worn in these areas.

k. Admitting parties into test areas. He will follow the radiation levels in the general regulations as a guide and will consider that no limitation is placed on the rate of accumulation, as long as the rate is sufficiently low as to permit adequate control.

l. Issuing clearances for removal of radioactive material from the test site.

m. Providing Rad-Safe check points as required for each target area.

n. Reporting to the Rad-Safe Officer all violations of the Radiological Safety Regulations.

o. Informing Logistics and Supply Officer as to anticipated future demands.

p. Keeping the On-Site situation map in the Rad-Safe Room posted for the Control Officer.

q. Scheduling duty officers who will be responsible for up-to-date maintenance of information concerning the radiological situation, and be responsible to him for On-Site requirements.

5. Logistics and Supply Officer: The Logistics and Supply Officer will be responsible for:

a. Transportation:

(1) Dispatch and control of all vehicles assigned to the Rad-Safe Group.

(2) Daily records of vehicle assignments and usage.

b. Supply:

(1) Maintain a stock of general expendable and nonexpendable supplies as required to support the Rad-Safe Group in fulfillment of its functions.

(2) Issue the above supplies as required to authorized personnel employed in test operations.

(3) Daily records of all supplies and equipment requisitioned, issued, expended, or turned in, in support of test operations.

c. Instruments:

(1) Maintain a stock of approved radiological safety type survey instruments and associated equipment for issue to Rad-Safe monitors.

(2) Establish and operate an electronics and electrical equipment repair shop in the basement of the Rad-Safe building which will be capable of repair and maintenance of all radiological detecting equipment.

(3) Maintain daily records of all equipment and supplies required to accomplish the above functions.

d. Exercising supervision over laundry facilities.

6. Control Section. The Control Section will consist of the Control Officer and personnel furnished by the Rad-Safe Support Unit with a representative from the Off-Site and On-Site Sections and an Air Liaison Officer. The Control Officer will be responsible for:

a. Maintaining all pertinent radiological data and coordinating all Rad-Safe activities and operations.

b. Maintaining complete up-to-date situation charts and maps showing Off-Site, On-Site, weather and air data.

c. Supervising the preparation of a predicted fall-out map prior to each operation.

d. Knowing the location of all working parties and monitoring groups and control of them through the On-Site Operations Officer.

e. Receiving and plotting data from the Air Participation Unit and coordinating with J-3 and CAA representatives with a view to returning airways to normal traffic operation.

f. Maintaining a journal of each day's activities.

TOM D. COLLISON
Lt Col, Cml C (Arty)
Rad-Safe Officer, NPG

Inclosure 2

RAD-SAFE INSTRUCTIONS TO PROGRAM PERSONNEL

OFFICE OF THE TEST DIRECTOR
Nevada Proving Grounds
Post Office Box L
Mercury, Nevada

9 March 1953

TO: See Distribution

FROM: Test Director

SUBJECT: RAD-SAFE INSTRUCTIONS TO PROGRAM PERSONNEL

1. Purpose: The purpose of this document is to acquaint all interested parties with the functioning of the Rad-Safe Unit so that On-Site operations may proceed with a minimum of interference and delay and yet be consistent with Rad-Safe requirements of the Test Director.

2. Coordination of Rad-Safe Requirements and Program Monitors: A member of the On-Site Operations Office will contact program leaders and heads of other interested agencies to explain in detail the operation of the On-Site Rad-Safe program, to ascertain the Rad-Safe requirements of all agencies, and in the case of programs, to introduce the program monitor. The program monitor will generally coordinate the program's need for Rad-Safe facilities and additional monitor requirements. The program monitor will leave his phone number, and may generally be reached through the On-Site Operations Office, or the R.S.S.U. Administrative Office.

3. Control in Contaminated Areas:

a. The On-Site Rad-Safe Section will determine the extent of contamination in the target area by daily surveys. All areas of radiation greater than 10 mr/hr will be controlled. Fixed and mobile check points will be established. Access to the area will require a clearance from the On-Site Operations Officer. For this clearance, contact your program monitor or the On-Site Operations Office. It is desired that arrangements for entry or clearance to the area be made 24 hours in advance. For shot days, a schedule for entry will be published by the Test Director.

b. In making arrangements for entry, either through the program monitor or through the On-Site Operations Office, party leaders should submit the following information:

(1) Program, project, or other agency

(2) Full name of all personnel in party

(3) Party leader

(4) Desired entry time and expected time of stay

(5) Locations to be visited

Receipt of such advance notice will materially assist the Rad-Safe Unit in reducing party processing time at the Rad-Safe building.

[redacted]

c. A map of the target area, showing radiation intensities, will be posted daily by the On-Site Operations Officer outside building 200 in the Mercury area for the convenience of project personnel.

d. Protective clothing, to be utilized only for wear in contaminated areas, may be obtained at the Rad-Safe building on a five day issue basis. Individuals scheduled for entry to controlled areas should draw their protective clothing in advance and dress in Mercury. When the protective clothing is contaminated, it will be exchanged for fresh clothing at the Rad-Safe building.

4. Party Control and Briefing: Parties reporting to the Rad-Safe building for processing into controlled areas will normally remain with their transportation. For large parties, the party leader only will enter the Rad-Safe building by the Clean Entrance on the east side balcony. He will pick up his monitor and contact the representative of the Plotting and Briefing Section located just inside the door, who will advise him as to further processing required. If the work load permits, all members of small parties may enter the Rad-Safe building for their briefing. Schedules of entry will be followed explicitly and parties will not congregate in or near the Rad-Safe building.

5. Return from Contaminated Areas: Personnel returning from contaminated areas must process through the Personnel Decontamination Station located in the Rad-Safe building. Enter via the Contaminated Entrance at the Southeast corner of the building.

6. Relation of Monitor to Party: Rad-Safe monitors assigned to individuals or groups working in contaminated areas, or with contaminated equipment during recovery operations, will act in an advisory capacity to keep the recovery party leader informed of radiation intensities at all times. The recovery party leader is expected to accept this advice and act accordingly. It is the responsibility of both the party leader and members of the recovery party to adhere to the limits established in the Rad-Safe Annex.

7. Vehicle Control: All vehicles used in contaminated areas will be checked through the Vehicle Decontamination Section before return to Camp Mercury or reentry into contaminated areas. A check point has been established south of the C.P. to assist in this process. Vehicles which exceed prescribed radiation tolerance levels will be decontaminated or otherwise disposed of, as determined by the Officer-in-Charge of the Vehicle Decon Station, in conjunction with the party leader concerned. In general, operational vehicles will not be decontaminated merely to serve as personnel transportation to Mercury, as a contaminated vehicle park has been established.

8. Telephone Numbers:

On-Site Operations Office -- 8263, 8264

R.S.S.U. Administrative Office -- 9288

TOM D. COLLISON
Lt. Col., Cml C (Arty)
Rad-Safe Officer, NPG

DISTRIBUTION:
"P"
S. R. Woodruff (50 cys) ATTN: All Contractors
1 - Test Director
1 - J-3
1 - On-Site Rad-Safe (Maj MacWilliams)
1 - Off-Site Rad-Safe (Mr. Johnson)
1 - Rad-Safe File

Chapter 2

SHOT ANNIE*

2.1 INTRODUCTION

2.1.1 At 0520 PST, 17 March 1953, the first shot of the Upshot-Knothole series, Annie, was detonated from a 300-ft tower in Area 3 of Yucca Flat, NPG. The decision to fire was made at 0830, 16 March 1953, after the 48-hr forecast indicated favorable weather for the shot.

2.1.2 The Rad-Safe Unit performed its mission without undue difficulties. The On-Site Initial Survey was completed and plotted for general use by 0650. Recovery parties were released to the 100 mr/hr line at 0640. General recovery, "R" hour, was announced at 0715. Contamination of the target area was generally to the east of ground zero. The eastern sector of the pattern was not delineated by the initial survey team as it was above 10 r/hr and did not interfere with recovery operations. The fall-out in the peripheral areas of NPG was to the east in a relatively narrow band (10 miles or less in width), extending from Alamo to Carp to immediately north of St. George, Utah. The maximum integrated infinity dose in the fall-out path was from 4 to 6 roentgens. St. George received approximately 0.5 roentgen dose. The aircraft assisting in the delineation of the fall-out pattern were generally satisfactory with the exception of a general lack of air to ground communications. This delayed receipt of the aerial data and hampered optimum utilization. Completion of the actual fall-out pattern (Incl. 1) from the air and ground survey data verified the fall-out forecast made at 0400 PST, 17 March 1953.

2.2 ON-SITE OPERATIONS

2.2.1 A dry run was made at 0600 D-1 day. Considerable difficulty was encountered with communications, although all radios had recently been in the communications shop for service.

2.2.2 The initial survey party, consisting of four teams, started at H+30 min, and the survey was completed by H+1½ hr. Communication with three of these four initial survey teams was satisfactory. Subsequent surveys were made daily through 21 March 1953. Additional surveys were made as required. Survey plots for all surveys are attached as Incl. 2.

2.2.3 One hundred thirteen (113) parties were briefed and cleared for entry into controlled areas during the period of this report. On shot day, area access clearance forms were submitted to parties prior to their call for briefing. This practice led to some loss of control. One party entered the contaminated area prior to R hour without being briefed or cleared.

* Period covered, 16 to 22 March 1953.

[redacted]

2.2.4 During the period, nine monitors received more than one (1) roentgen cumulative exposure. Of these, the highest was 1.906 roentgens. Some monitor personnel were found to need more orientation on the shot area and the processing procedure in the Rad-Safe Building. In general, all monitoring requirements were satisfactorily met.

2.2.5 Approximately fifteen hundred film badges were processed during the period. Eleven personnel received more than 2 roentgens cumulative exposure. Of these, ten were project personnel and one was the Rad-Safe Control Officer, who took a ground zero reading on D + 3 days. Highest exposure reported for the period was 3.385 roentgens.

2.2.6 Fifty (50) vehicles were found to be contaminated above tolerance levels and were decontaminated during the period. Two (2) vehicles were temporarily placed in the Hot Park to allow decay of contamination. They were subsequently decontaminated and released.

2.2.7 A vehicle check point was maintained on Mercury Highway just south of the CP entrance to check vehicle decontamination.

2.2.8 Experience from this period shows that

(a) Some monitors had not received sufficient orientation in the test area.

(b) Standby monitors were not prepared to assume missions without delay.

(c) Area access forms were given to parties prior to their scheduled briefing. In the future, the access form will be issued after all other processing is completed.

2.3 OFF-SITE OPERATIONS

2.3.1 Fixed and mobile monitors were distributed on D−1 day as shown in Incl. 3.

2.3.2 The wind pattern at H hour resulted in an abnormally narrow distribution of the fall-out of radioactive material (see Sec. 2, WT-705). In general, the predicted path of fall-out from the 0400 wind was almost due east of ground zero with the bulk of the activity concentrated in a narrow path only a few miles wide.

2.3.3 Measurable activity was detected on the ground on Highway 93 from 25 to 65 miles south of Alamo. Activity was also detected on Nevada Highway 55 in the interval from 10 to 30 miles north of Highway 91. On Highway 91 activity was detected from 46 miles west of St. George to St. George. Fall-out also occurred from 3 miles south of St. George to 15 miles north of St. George. On Highway 91 from St. George to Cedar City, activity was measured as far as 26 miles northeast of St. George. Highway Utah 15 was surveyed as far east as Zion National Park, and activity was detected all along this route. The towns of Virgin, Hurricane, Springdale, and Rockville were generally in the fall-out path. The data from the monitors' reports on inhabited localities and at the centers of activity on highways are shown in Incl. 5, Chap. 2, of WT-702(REF.). Air samples taken at St. George, Mesquite, and Glendale Junction showed airborne activity. Late fall-out, undetectable by field survey instruments, was measured at Mesquite and Glendale Junction. These data are presented in Incl. 6, Chap. 2 of WT-702(REF.).

2.3.4 Some information on the difference between exposure inside and outside of buildings was obtained at St. George. A background recorder with a film badge attached was located in the shop building of Dixie College. The background recorder showed a maximum reading of 0.4 mr/hr. The film badge on the recorder showed no reading. The film badge of the monitor working in this area showed an exposure of 140 mr, and the outside radiation intensity reading was 26 mr/hr.

2.3.5 Inclosure 4 shows the highest rates at inhabited localities and on highways, with the time of reading, and the calculated infinite dose based on the $t^{-1.2}$ decay law. Inclosure 5 shows the fall-out pattern as determined by analysis of the ground monitors' reports.

2.3.6 Radio reception and transmission were generally good from about 0600 to 0845 on D day. After this time, the AEC Communications men reported that climatic interference was proving generally troublesome on all HF networks. From 0845 to 1445 a total of nine radio

messages were received at the CP. Three of these were from Groom Mine, three from the Ely-Tonopah-Beatty region, and the other three from what might be considered the region of immediate interest at that time, the area to the east. Radio reception was considerably improved from 1445 until 1813 except in the town of St. George. From this time until sign-off at 2200, radio communication was unsatisfactory.

2.4 AIRCRAFT PARTICIPATION

2.4.1 The aircraft participation consisted of a close-in terrain survey (performed by an L-20 aircraft), an extended terrain survey (performed by L-20 and C-47 aircraft), and a cloud tracking operation (performed by two B-29's and one B-25 aircraft).

2.4.1.1 The close-in terrain survey was scheduled to be performed by a helicopter. However, since the helicopter had not arrived at the test site in time to participate in the D−1 day dry run, it was not used on D-day to assist the initial aerial on-site survey of the target area. An L-20, the crew of which had been rehearsed, was used. This plane left Indian Springs AFB at H +2 min, made a survey of the Mercury Highway up to a point adjacent to ground zero, and proceeded in a square pattern around ground zero at a distance of approximately 2 miles, in order to verify the direction of fall-out in the immediate vicinity of ground zero. The L-20 then checked Tower No. 4 to give immediate results as to the contamination in that area. The survey was continued to the north end of Yucca Flat, down the east side of the flat to Frenchman Flat, and back to Indian Springs on a route east of the test site. Because of the high minimum speed of the aircraft, difficulties were encountered in relaying accurate data to the Control Point. By the time the monitor had taken down a reading, given the pilot directions, and performed the radio call, he had already passed his next planned point of reading. Only limited use was made of this survey.

2.4.1.2 The extended terrain survey consisted of two parts. The portion radially within 20 miles of ground zero was performed by a second mission of the L-20 aircraft used on the initial survey. The extended portion was performed by a C-47 aircraft. Both aircraft flew at 500 ft above the terrain commensurate with safety.

The L-20 flew a prescribed pattern based on the grid system shown in Incl. 9, Chap. 2, of WT-702(REF.), and reported the radiological data shown in Incl. 10, Chap. 2, of WT-702(REF.). The aircraft left Indian Springs AFB at H +2 hr 25 min with a Rad-Safe monitor and performed the mission as planned. Since communications were unsatisfactory throughout the flight, data from this flight were not obtained until completion of the mission.

The extended portion performed by the C-47 aircraft was planned in a similar manner. The plane left Indian Springs AFB at H +2 hr but did not complete its prescribed pattern, because, in order to establish communications, the aircraft frequently had to fly out of the pattern and was eventually forced to return to base because of a shortage of gas. In preparing the survey pattern, it was realized that the C-47 would run into some air contamination. However, as it was considered important to clearly delineate the maximum fall-out area early, the plane was put in the air at H +2 hr on the pattern indicated. The contamination received by the aircraft was low and did not interfere with the mission. The pattern flown and data for the C-47 are shown in Incl. 11, Chap. 2, of WT-702(REF.). The grid system is that shown in Incl. 9, Chap. 2, of WT-702(REF.). The monitoring instruments used in the aircraft were two MX-5's, two T1B's, one Scintelog and recorder obtained from the NYOO, AEC. The C-47 also had a C-1 filter with an MX-5 indicator. Inclosure 12, Chap. 2, of WT-702(REF.) contains a plot made from data from each instrument. Inclosure 1 is a plot made from the air and ground survey results.

2.4.1.3 The cloud tracking operation was to give a track of the cloud at three different levels by aircraft assigned to Rad-Safe. The top of the mushroom was to be located and tracked by the cloud sampler aircraft. At the 12,000 ft level, tracking was performed by a B-25 aircraft, starting its mission at H+15 min. At detailed briefing the pilot was told to fly the 5 mr/hr line of the leading edge of the contaminated air mass at the 12,000 ft level; the pilot, however, visually followed the mushroom of the cloud. Data collected by this aircraft are listed in Incl. 13, Chap. 2, of WT-702(REF.).

Two B-29's were to track the cloud at 18,000 and 22,000 ft msl. They left Kirtland Air Force Base on schedule and arrived over their orbit point (the Las Vegas Radio Range Station). Through lack of further direction, they continued to orbit at this location until approximately 0830 hr. At approximately 0830 hr they were directed to proceed from the intersection of Amber-2 and Red-6 Airways to Bryce Canyon on Red Airway to determine the contamination along these airways at 18,000 and 22,000 ft. The B-29 at 18,000 ft was directed to descend to 14,000 ft and survey the air mass at that level from Bryce Canyon on Red-6 to the intersection of Red-6 and Amber-2 Airways. It was found at 1123 hr that the airways were clear at this altitude. This B-29 was then released and returned to base. The second B-29, which originally was at 22,000 ft, having found Red-6 clear at 22,000 ft at 1012 hr, was directed to descend to 18,000 ft and survey the airways from Bryce Canyon to intersection of Red-6 and Amber-2. He reported the airway clear at 18,000 ft at 1148 hr. This plane was then released.

Data collected by the two B-29 cloud trackers are shown in Incl. 14, Chap. 2, of WT-702 (REF.). The predicted cloud trajectory as of 0300, 17 March is shown in Incl. 15, Chap. 2 of WT-702(REF.). The actual trajectory plotted from the data obtained is shown in Incl. 6.

2.4.2 A summary of aircraft participation follows.

2.4.2.1 Generally speaking, the greatest difficulty encountered was that of faulty communications. VHF communications could not be depended upon at low altitudes except within 20 miles of ground zero. HF communication was never established due to trouble at the local repeater station. To prevent a recurrence of these difficulties on subsequent shots, a test was made on D+1 day using the C-47 aircraft in an extended 360° pattern to check at low altitudes the HF network out to a range of approximately 150 miles. No difficulty was encountered on this flight, which ranged as far as the east slopes of the Sierra Nevada Mountains. No radioactive contamination was found on this flight.

2.5 LOGISTICS AND SUPPLY

2.5.1 For the period of 16 to 23 March, the Supply Section issued 1958 shoe covers, 834 protective caps, 951 coveralls, 824 cotton gloves, 1058 high density goggles, 78 protective goggles, and 190 respirators. The laundry serviced 651 shoe covers, 494 protective caps, 579 coveralls, 494 cotton gloves, 109 respirators, 14 pillowcases, 42 sheets, and 65 towels.

2.5.2 Prior to 16 March, 198 AN/PDR T1B's, 64 SU10's, 90 MX-5's, 73 AN/PDR 39's, 85 Victoreen 389A's, 4 AN/PDR-10A's, and 2 Pee Wee No. 211 survey instruments were on hand and calibrated. During the period 16 to 22 March, 93 survey instruments were recalibrated and 50 repaired.

2.5.3 Second echelon maintenance was performed on 21 military vehicles. Four vehicles were deadlined owing to lack of spare parts.

2.5.4 Communication for this shot was not satisfactory. Installation of the 6-volt radios in the military weapons carriers (M-37) was unsatisfactory for this first shot, although different modifications were tried prior to the shot.

2.6 GENERAL

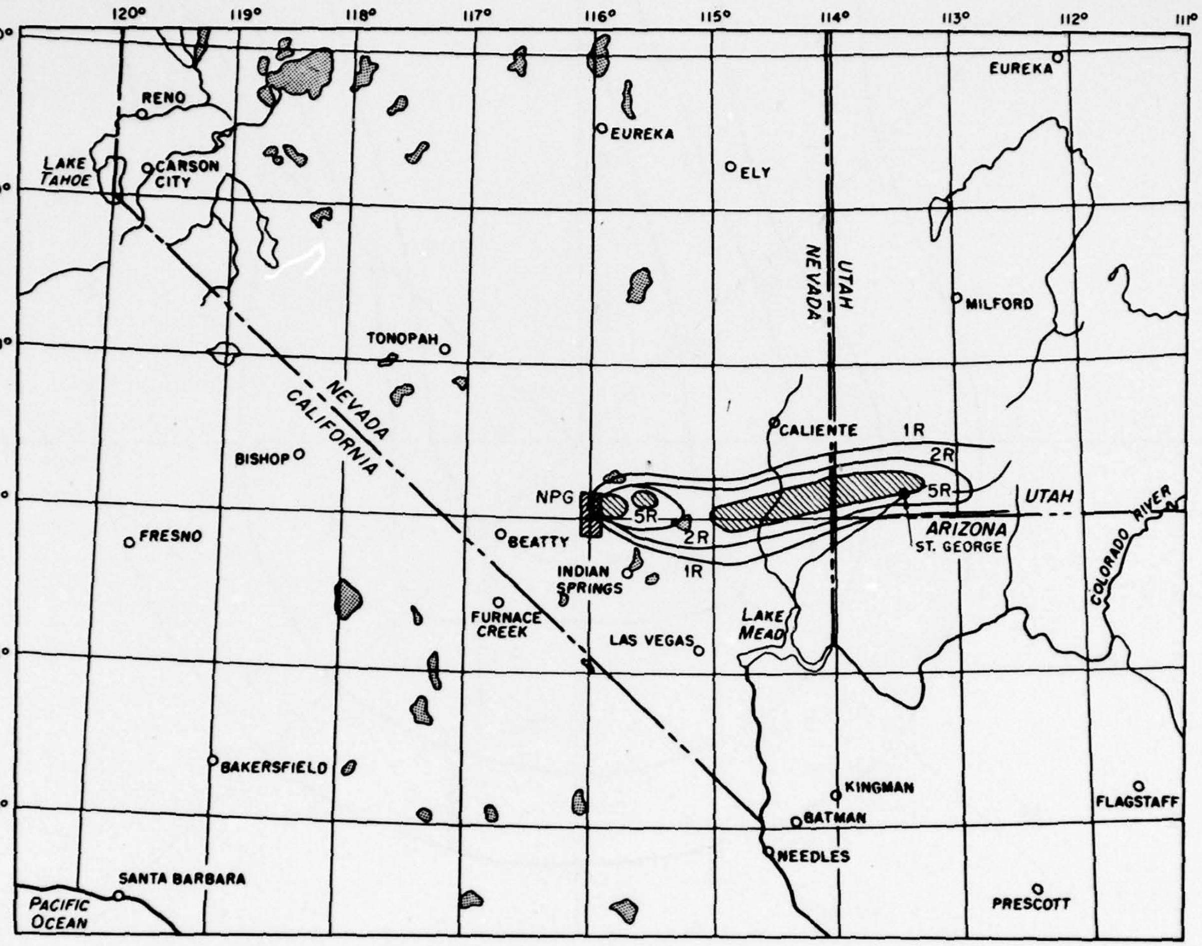
The Rad-Safe Organization as a whole functioned efficiently. Information from the field was presented by the Rad-Safe Control Room in a satisfactory manner. General interest started with the On-Site situation and after R hour shifted to the cloud path and the fall-out area. The Off-Site fall-out pattern was fairly well presented by Off-Site ground monitors and the Aerial Terrain Survey. The lack of radio communications delayed presentation of all phases of data. Off-Site Operations had to resort to telephone to obtain data from Off-Site ground monitors. The aerial monitors telephoned their information into the control room after they landed at Indian Springs.

[redacted]

UNCLASSIFIED

Inclosure 1

INFINITE DOSE FALL-OUT PATTERN



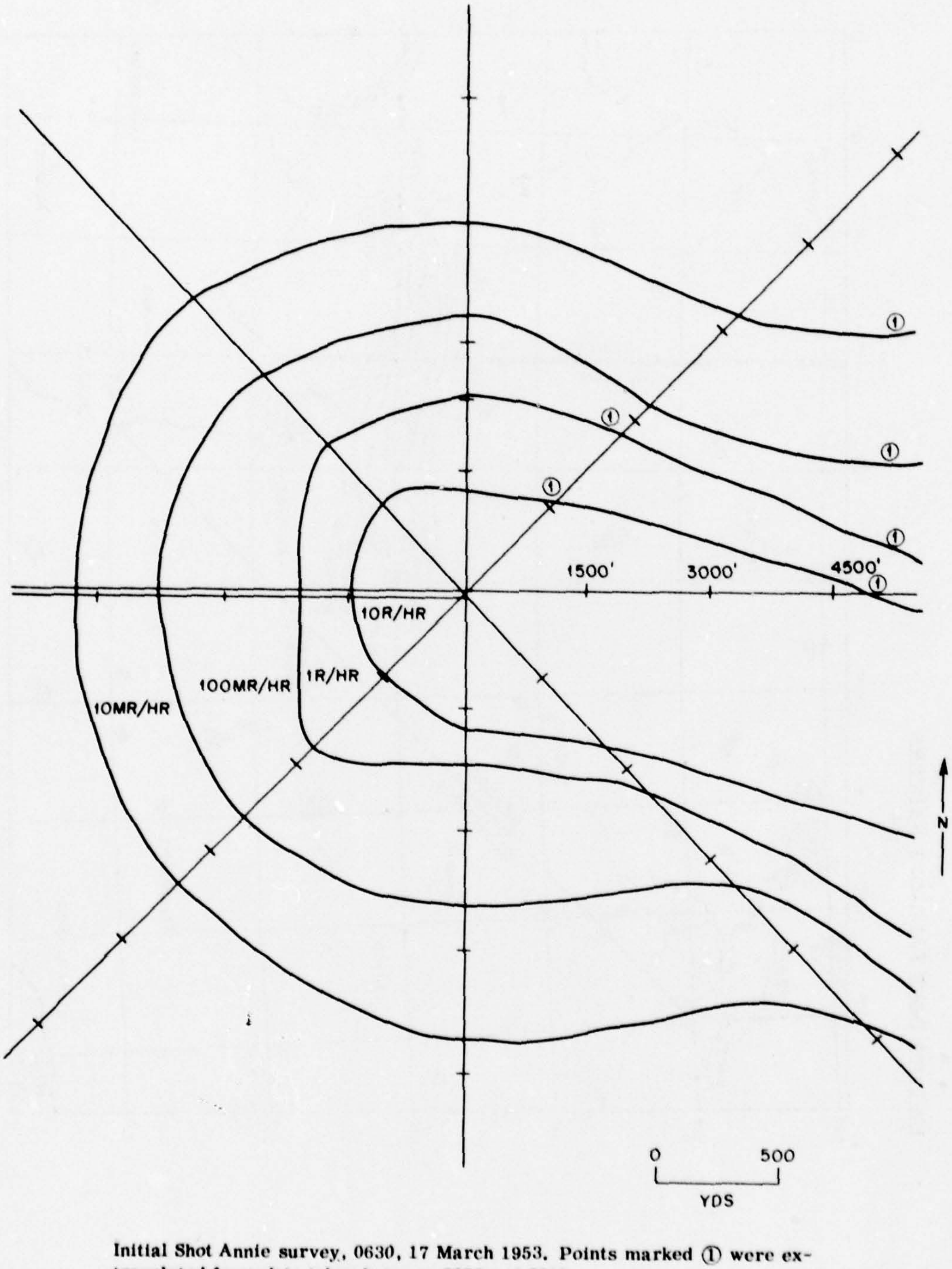
Data based on combined air and ground survey. Shot Annie, 17 March 1953.

[redacted]

UNCLASSIFIED

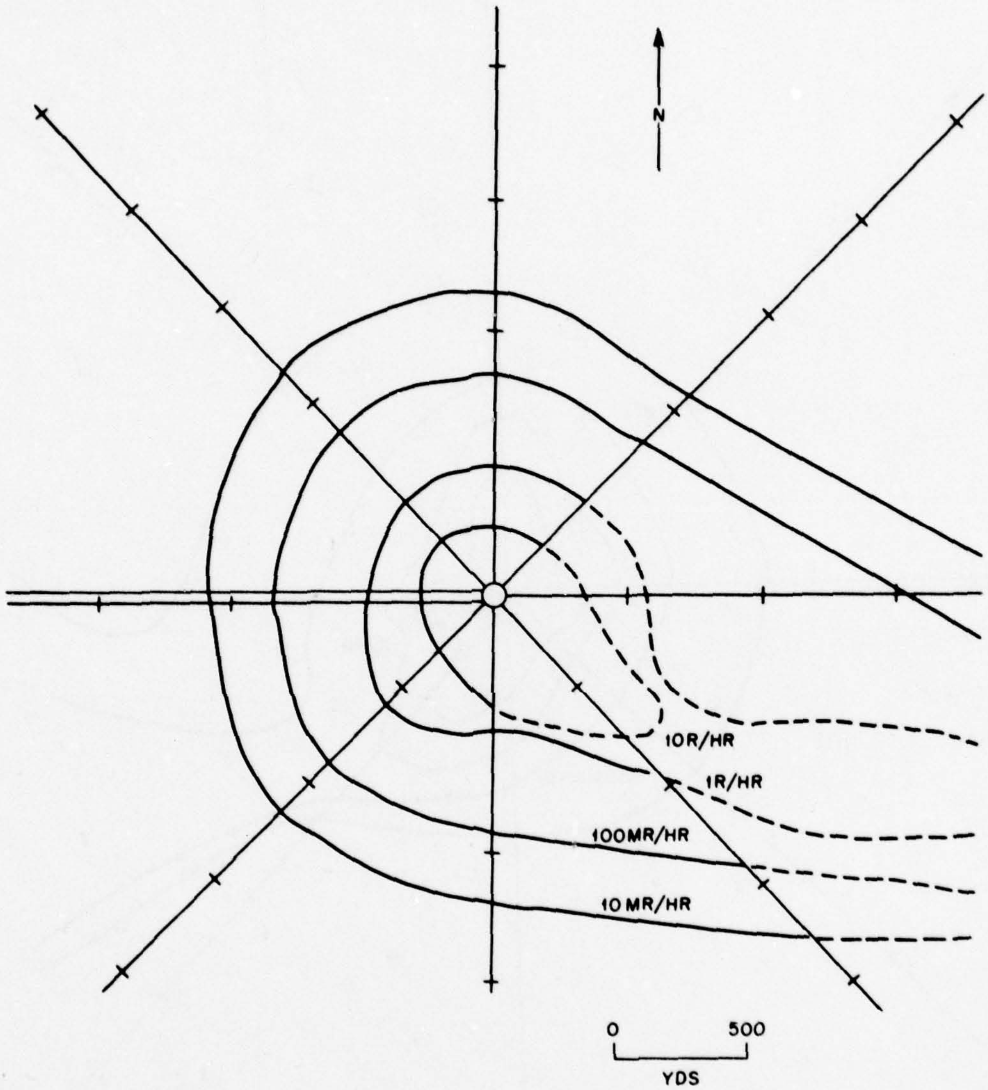
Inclosure 2

SURVEYS OF TEST AREA 3

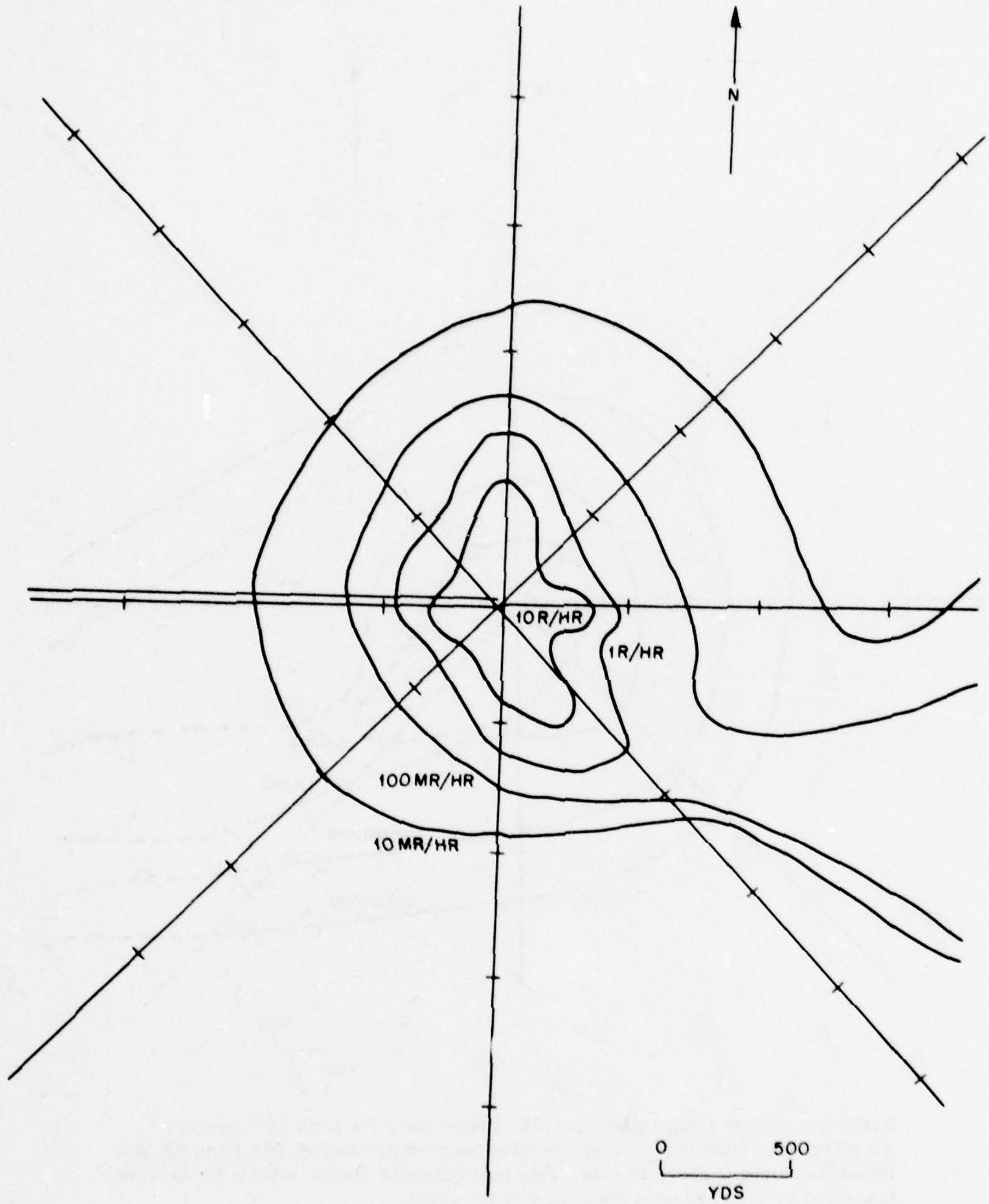


Initial Shot Annie survey, 0630, 17 March 1953. Points marked (1) were extrapolated from data taken between 0830 and 0915.

[redacted]

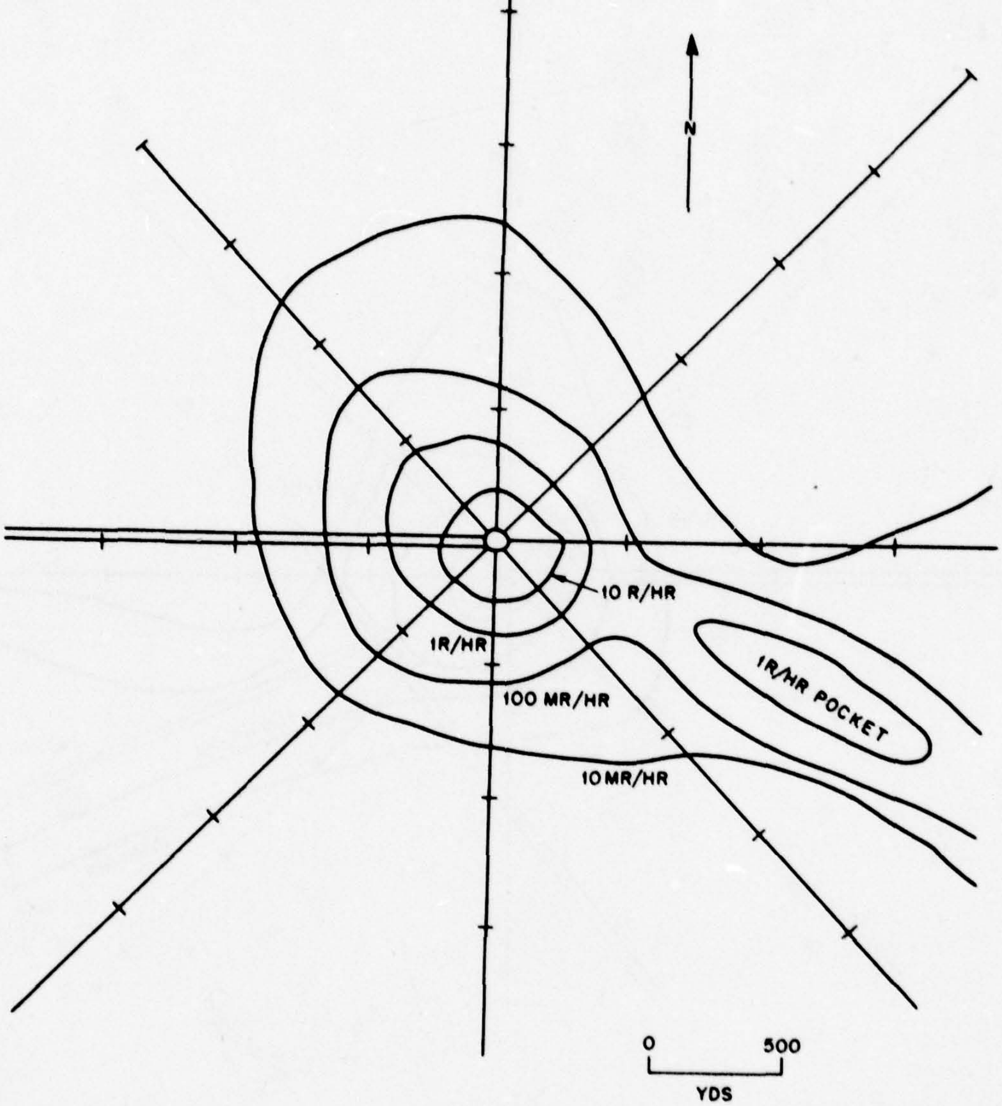


Resurvey, 0600 to 1100, 18 March 1953. Dotted lines are from 1100 survey. All other lines from 0600 survey. At 0600 the road proceeding ESE from GZ had intensities along it above 10 r/hr. This contamination shifted rapidly for several hours and by 1100 had been dissipated by the winds.



Resurvey, 0630, 19 March 1953.

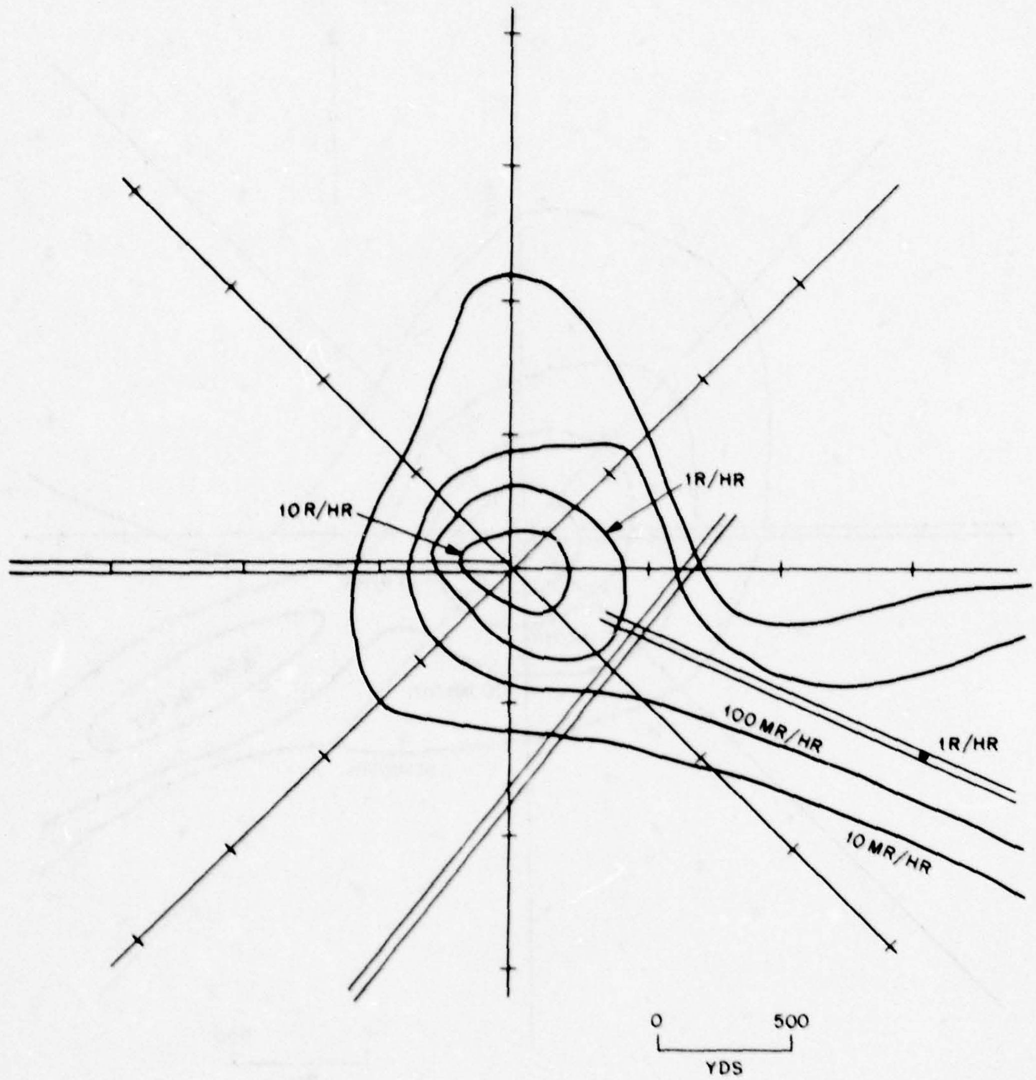
[redacted]



Resurvey, 0630, 20 March 1953.

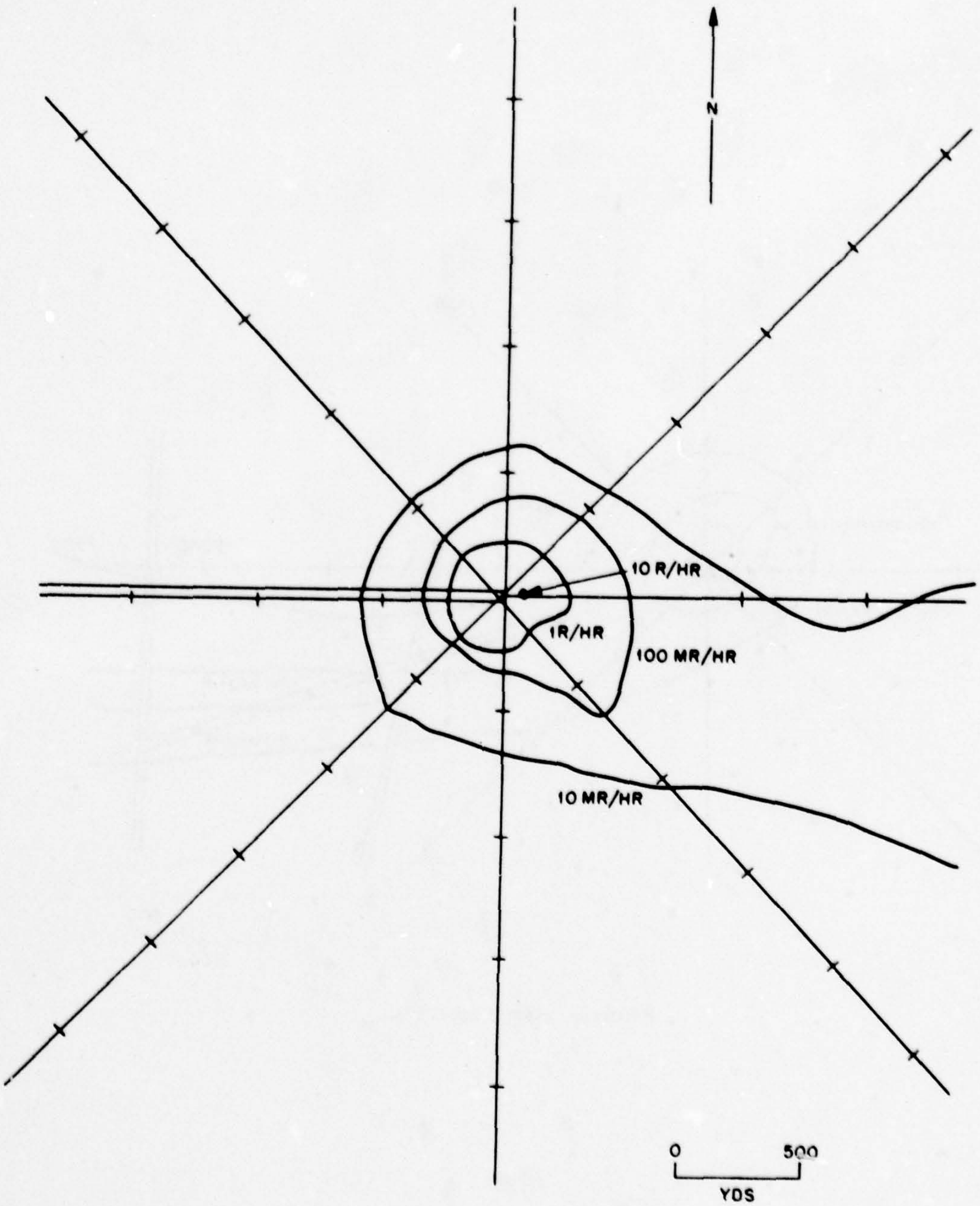
[redacted]

UNCLASSIFIED



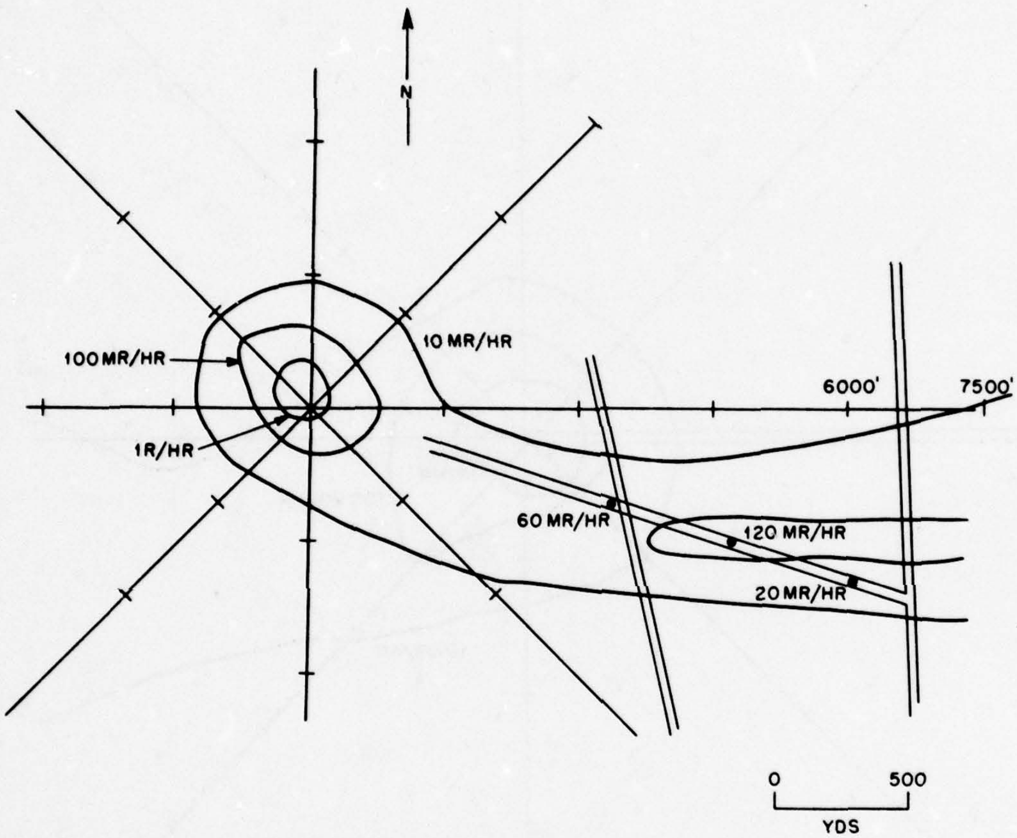
Resurvey, 0630, 21 March 1953.

[redacted]

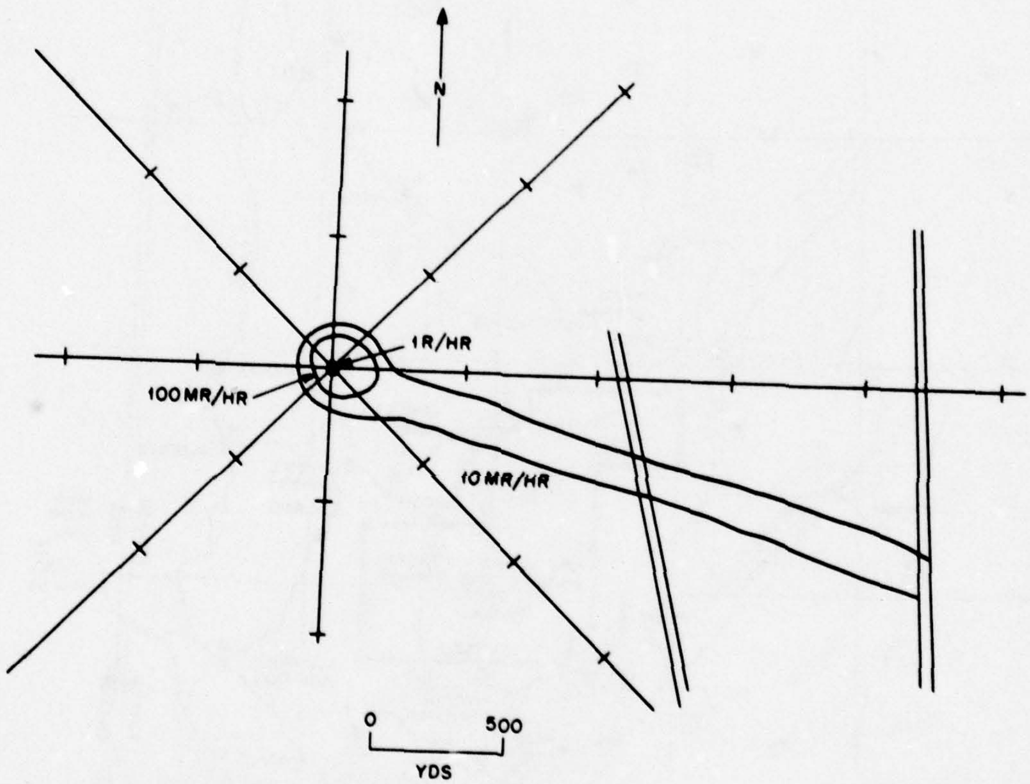


Resurvey, 1100, 23 March 1953.

[redacted]



Resurvey, 0700, 2 April 1953.



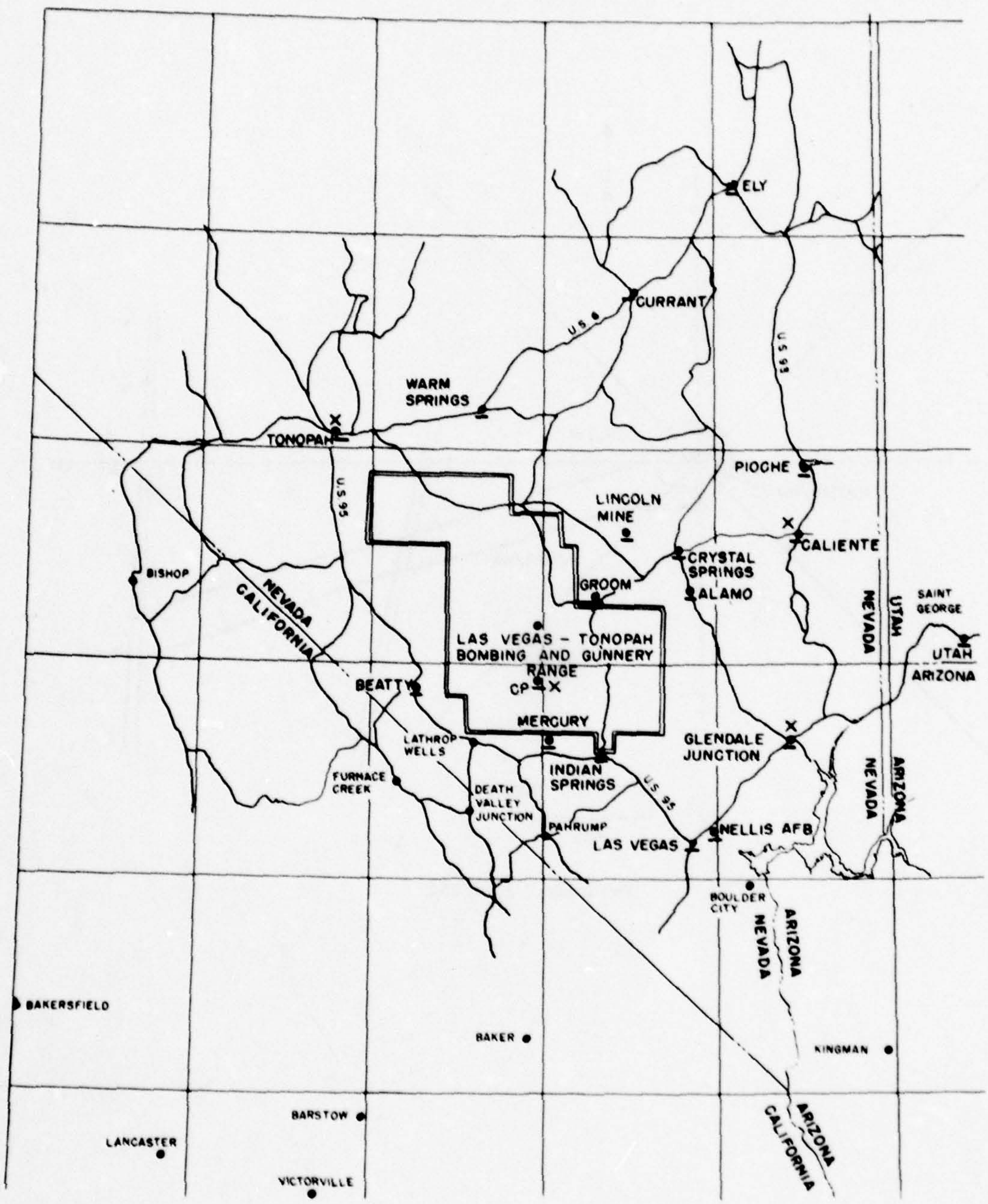
Resurvey, 7 April 1953.

[redacted]

UNCLASSIFIED

Inclosure 3

DISTRIBUTION OF FIXED AND MOBILE OFF-SITE MONITORS, D-1, SHOT ANNIE



Distribution of monitors on D-1, Shot Annie. ●, fixed stations. ×, mobile monitors.

[redacted]

UNCLASSIFIED

Inclosure 4

CALCULATED INFINITE DOSE, SHOT ANNIE

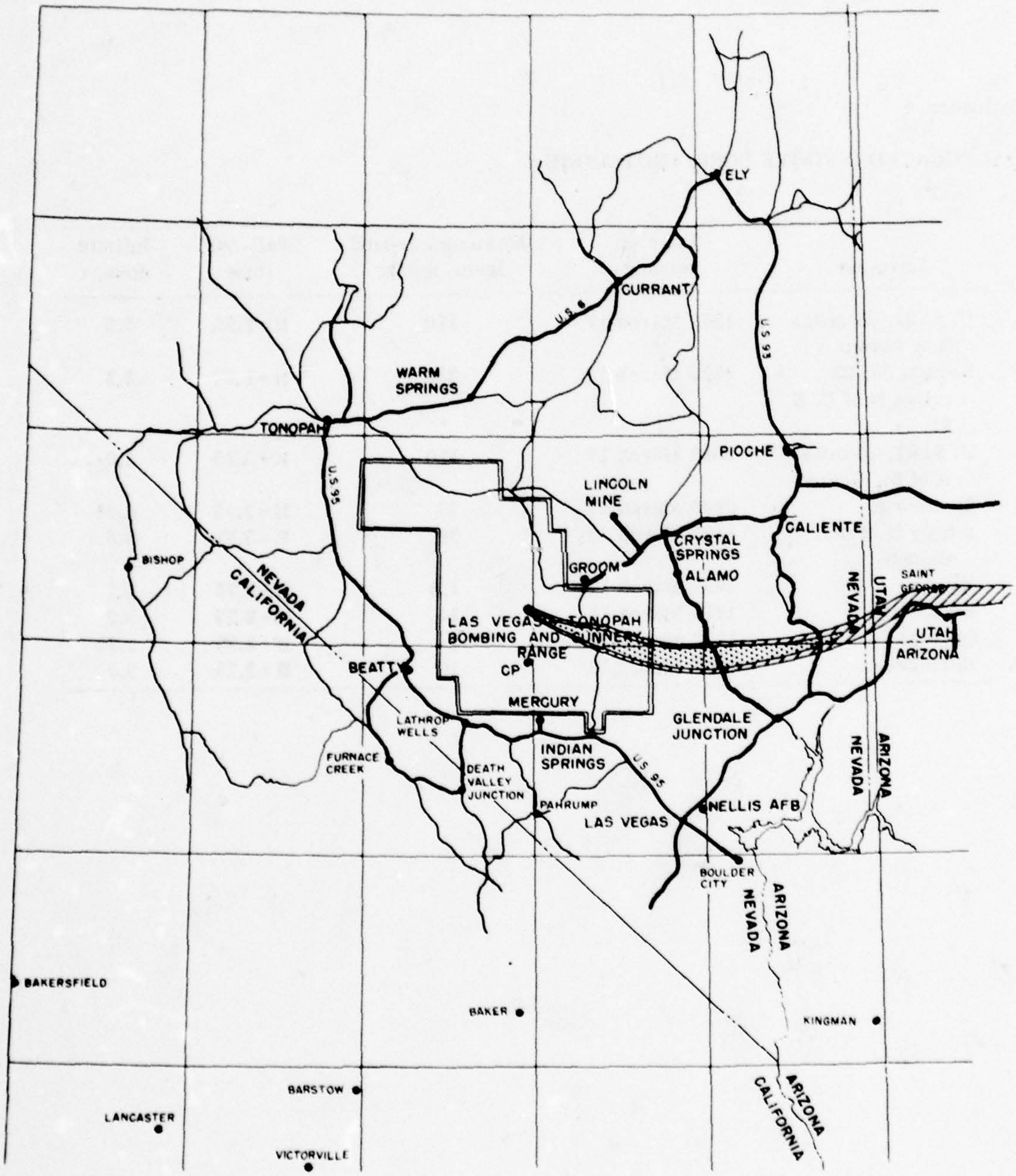
Location	Time of reading	Maximum ground level, mr/hr	Fall-out time	Infinite dose, r
U. S. 93, 30 miles S of Alamo	1240 March 17	110	H+1.25	5.5
Nevada 55, 22 miles N of U. S. 91	0800 March 17	260	H+1.67	3.5
U. S. 91, 10 miles N of St. George	1025 March 17	110	H+2.75	3.0
St. George	0845 March 17	26	H+2.75	0.55
1 mile N of St. George	1325 March 17	70	H+2.75	3.5
Virgin	1635 March 17	1.6	H+2.75	0.1
Rockville	1715 March 17	24	H+2.75	3.0
Springdale	1730 March 17	8	H+2.75	1.25
Hurricane	1016 March 18	10	H+2.75	2.5

[redacted]

UNCLASSIFIED

Inclosure 5

GROUND MONITORING RESULTS, SHOT ANNIE



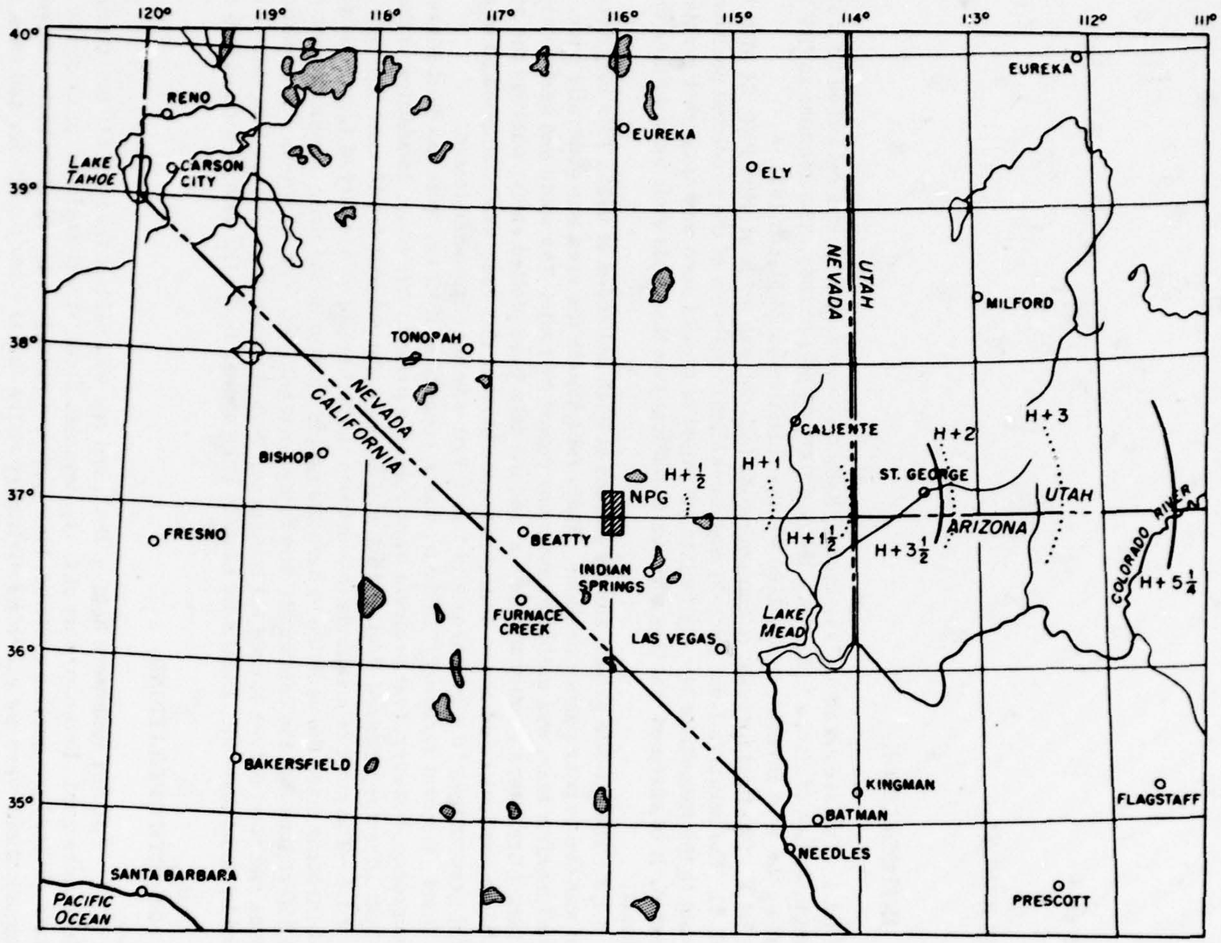
Shot Annie, spring 1953. , 400 mr/hr or above at time of fall-out. , 200 to 400 mr/hr at time of fall-out. Heavy lines show the monitoring runs.

[redacted]

UNCLASSIFIED

Inclosure 6

ACTUAL CLOUD TRACK, 17 MARCH 1953



......, cloud top. ——, 18,000 to 22,000 ft altitude. Cloud top, 41,000 ft msl.

UNCLASSIFIED

Chapter 3

SHOT NANCY*

3.1 INTRODUCTION

3.1.1 The second shot of the Upshot/Knothole series, Nancy, was detonated on a 300 ft tower in Area 4 of Yucca Flat, NPG, at 0510 PST, 24 March 1953. The decision to fire was made by the Test Director at the 2100 weather briefing on 23 March 1953.

3.1.2 The final forecast of contamination fall-out was made at 0400 PST, 24 March 1953 (Incl. 1). The actual fall-out (Incl. 2) was somewhat to the west of the predicted position. The fall-out in the immediate vicinity (within 20 miles) of ground zero was somewhat greater than expected. It is assumed that this was due to the fact that the winds aloft were weaker than forecast.

3.1.3 The On-Site ground survey started at 0545 and ended at 0830. This long period of time was due to poor communications. Radio reception in the area was generally poor. One ground monitor team was unable to make any report by radio. The south and east portions of the target area were readily accessible, and the data were plotted early; whereas the northwest and north portions could not be delineated since most of this area was contaminated to an extent greater than 10 r/hr. Area 2 in Yucca Flat was heavily contaminated.

3.1.4 General recovery, "R" hour, was announced at H+2 hr. With the Test Director's concurrence, however, four projects were released prior to this time. In addition to the above, the Test Director released Project 15.4 at R hour to proceed past the 10 r/hr intensity line.

3.1.5 The point of maximum fall-out was in the immediate vicinity of Lincoln Mine. The Test Director made the decision to have the people remain inside their homes as soon as it was determined that the community was being contaminated. The maximum integrated dose of gamma radiation did not exceed 3.4 roentgens. With the personnel indoors this value was reduced by about one-half. Details on Lincoln Mine appear in the Off-Site section of this chapter.

3.2 ON-SITE OPERATIONS

3.2.1 Two dry runs were held on D−3, and one was held on D−1 at 0510 hr. Communications were good. In the evening of D−1, Reynolds Electric and Engineering Company technicians checked the ignition systems, batteries, and radio hookups on all vehicles; however, communications were not entirely satisfactory on the initial survey on D-day and caused some delay.

3.2.2 The initial survey party was dispatched from the Rad-Safe Building at 0520 hr and completed the survey at 0711 hr. Two stake lines could not be reached as they lay entirely

*Period covered, 23 to 29 March 1953.

[redacted]

within the 10 r/hr iso-intensity line. One party of two monitors in the initial survey team received a cumulative exposure greater than the maximum permissible exposure. It was determined that this overexposure was a result of carelessness, since the men did not turn on their survey meter until they had reached their initial stake line, where they found they were being exposed to an intensity greater than 50 r/hr. Subsequent surveys were made daily through 28 March 1953, with additional surveys made as required. The survey plots for all surveys of this area are attached as Incl. 3. A ground zero reading of 240 r/hr was made at 1000 on D+1 day.

3.2.3 Three hundred fifty-three (353) persons in ninety-three (93) parties were briefed and cleared for entry to controlled areas during the period of this report. Processing procedures for parties clearing the Rad-Safe Building were streamlined during this period by requiring personnel to go directly to the plotting and briefing room and then through the operations office for a final clearance. This reduced the over-all time required to process a party through the building. To accomplish this, an additional clerk was assigned to the plotting and briefing section.

3.2.4 The cumulative exposures for Rad-Safe monitors at the end of this reporting period show that 3 monitors have received more than 3 r and that 18 have received more than 1 r. The average cumulative exposure for the monitoring section was six hundred fifty (650) milliroentgens.

3.2.5 (a) Approximately eighteen hundred eighty (1880) film badges were processed during this period; of these, some nine hundred were badges issued to the FCDA-Joint Information Office observers for Shot Annie.

(b) Calibration curves were run on the modified 502-606 film-badge packets which had been previously returned to DuPont for modification of the lead shield. These badges were found to be entirely satisfactory, and plans were made to shift to the modified badges for the next shot.

(c) Two persons from Project 6.8 were reported to the Rad-Safe Officer as having exceeded the maximum permissible exposure of 3.9 roentgens.

3.2.6 Fifty-two (52) vehicles were decontaminated during this reporting period. One (1) vehicle was temporarily placed in the Hot Park and later released. Surveys were made of all motor pools in Mercury on the nights of 25 and 26 March 1953. Three contaminated vehicles were discovered in the AEC Motor Pool. These vehicles were decontaminated on 26 March 1953. The vehicle check point located on Mercury Highway was moved north of the access road to CP Building No. 1. All vehicles out of the area north of the CP are checked at this point. It was felt this would prevent recurrence of such incidents.

3.2.7 Warning signs to designate contaminated areas were posted on all access roads leading to Areas T-2, T-3, and T-4. An officer of the Monitoring Section was assigned the duty of checking all access roads leading to contaminated areas and posting signs on contaminated areas. This reduced the requirement for many of the check points.

3.3 OFF-SITE OPERATIONS

3.3.1 Fixed and mobile monitors were distributed on D−1 day as shown in Incl. 4.

3.3.2 The changes in the anticipated fall-out pattern, as delineated in the maps provided by the Air Weather Service Unit (Sec. II, WT-705), show that the area of primary interest would be in the vicinity of Lincoln Mine and north. The movement of personnel and equipment to provide maximum coverage for the communities in this sector is described in Inc. 5, Chap. 3, of WT-702(REF.), the Off-Site Activities Journal for the period.

3.3.3 Measurable activity was detected at points along U. S. Highway 6 between Ely and Tonopah, U. S. Highway 93 between Ely and Pioche, Nevada Highway 38 between Hiko and U. S. Highway 6, Nevada Highway 25 in the vicinity of Lincoln Mine, and on the desert road northwest of Groom Lake. Communities receiving fall-out were Lincoln Mine, Adaven, Sunnyside, Lund,

[redacted]

Preston, Ely, Currant, Duckwater, and Warm Springs. A documentation of the actual levels encountered in most of these areas is given in Incls. 6 and 7, Chap. 3 of WT-702(REF.) and in Incl. 5 of this report. Details of the report on Lincoln Mine are covered in Sec. 3.3.6. Confirmatory air sampling results at several of the locations given in Sec. 3.3.3 were obtained and are shown in Incl. 8, Chap. 3, of WT-702(REF.). Water samples of interest collected by Off-Site personnel are listed in Incl. 9, Chap. 3, of WT-702(REF.).

3.3.4 The final fall-out pattern as determined from all the ground survey information collected is illustrated in Incl. 6.

3.3.5 Radio reception was generally poor. This was expected, however; and by prior planning, good use was made of the available telephone lines. Data from Lincoln Mine were telephoned to Groom Mine on a field line, and then radioed to the CP by the VHF On-Site net.

3.3.6 Fall-out at Lincoln Mine.

3.3.6.1 The Lincoln Mine monitoring station was established at 1600, 23 March 1953. Equipment used consisted of a Hi-volume sampler, a background recorder, fall-out trays, cascade impactor, and survey instruments consisting of a T1B, an AN/PDR 34, an MX-5, and a Victoreen 389. Two monitors, H. J. L. Rechen, Sanitary Engineer, PHS, and E. S. Claborn, ACD, USN, were assigned.

3.3.6.2 Atomic cloud debris became visible to Lincoln Mine at 0550 PST. The cloud passed directly overhead at 0615. Three separate clouds were apparent, all moving in a NNE direction. A low level cloud passed the station at 0625.

Fall-out was first noticed at 0650 with a reading of 3 mr/hr. By 0709 a peak reading of 580 mr/hr was noted. At 0720 the fall-out appeared complete. Inclosure 7 is a graphical record of the readings taken at Lincoln Mine. The actual readings are tabulated in Incl. 12, Chap. 3, of WT-702(REF.).

At 0650 PST, the monitor in charge of the station informed Mr. Perkins, the Mine Superintendent, of the situation and asked if the personnel at Lincoln Mine could not take cover. The suggestion was accepted and acted upon immediately. Formal instructions from the CP confirming the above action were received at 0704. At 0900 instructions were that normal activities could be resumed. This was passed to the Superintendent.

At 0740 PST, a low level cloud was observed 5 miles west of Lincoln Mine. The cloud appeared to be traveling at the rate of approximately 10 to 15 mph, and appeared to fill the width of Penoyer Valley. Its maximum altitude was about 2000 ft above ground. A reading was made at Shadow Ranch (about six people live here) 4.5 miles NW of Lincoln at 1210. This reading was 120 mr/hr. At this same time the reading at Lincoln Mine was 90 mr/hr.

Joseph B. Sanders, AEC-LVFO, arrived at Lincoln Mine at 0920. Maj J. Servis, Cml C, and Duncan Holaday, PHS, members of the Off-Site Section, visited the mine at 1300.

3.3.6.3 It is believed that the personnel at Lincoln Mine did not receive a dosage greater than 3.4 r. In Incl. 7 the readings taken for the first 12 hr are plotted. A maximum lifetime dosage of 3.4 r was computed by measuring the first 12-hr dose from the curve, and computing the rest using the $t^{-1.2}$ law. As the workers and inhabitants of Lincoln Mine were inside for the greater part of the period of high intensity readings, and as at 0730 the reading outdoors was 350 mr/hr and the reading at this same time in a typical one-room frame house was 200 mr/hr, it is felt that most of the inhabitants received less than 2 r total dosage.

3.3.6.4 Inclosure 13, Chap. 3, of WT-702(REF.) shows the film-badge record of the monitors, a telephone lineman, and a Lincoln Mine resident. The results of a water analysis of two samples taken at Lincoln Mine are shown in Incl. 9, Chap. 3, of WT-702(REF.). Airborne concentrations are shown in Incl. 14, Chap. 3, of WT-702(REF.). The increase in particle size following primary fall-out is attributed to rising surface winds which necessarily caused surface agitation.

[redacted]

UNCLASSIFIED

3.4 AIR PARTICIPATION

3.4.1 Weather data indicated that the radioactive air mass would travel in a northeasterly direction. Recommendations were made to close the air space at all altitudes for a radius of 50 miles from ground zero from 0430 to 0600 hr, PST, on D-day. In addition, the air space enclosed by the 330° and 50° vectors from ground zero for a distance of 210 miles at 20,000 ft msl and below was recommended closed to all aircraft except those taking part in the test operation from 0500 to 1100 hr PST on D-day. The air space above 20,000 ft msl enclosed by the vectors 50° and 75° from ground zero (changed at 0945 to 10° and 60°) and a radial distance of 350 miles were also recommended closed. In addition to the above a warning area of a 240 mile radius from Melford Radio at all altitudes was recommended. No changes except the one noted above were required.

3.4.2 The cloud tracking aircraft, two B-29's and one B-25, were off on schedule. They performed their mission very effectively, considering the fact that the cloud broke up and scattered widely at almost all altitudes. The data are shown as Incl. 15, Chap. 3, of WT-702(REF.). The cloud track from these data is plotted in Incl. 8. The predicted cloud track is shown in Incl. 9. The altitudes of the tracking aircraft were: one B-29 at 22,000 ft msl and at 18,000 ft msl, and the B-24 at 12,000 ft msl.

3.4.3 The extended terrain survey was performed by an L-20 and a C-47 aircraft. The data collected were satisfactory. Communication, however, with the L-20 was never established, and consequently data were not delivered until after the mission was completed. The L-20 was off at 0640 and had completed the survey by 0940. The C-47 was off at 0810 and was able to complete the assigned pattern by 1250 hr. Communication was satisfactory with the C-47 on high frequency. The data and pattern from both the C-47 and L-20 are shown in Incl. 18, Chap. 3, of WT-702(REF.).

On D+1 day the C-47 performed a 360° aerial survey around the proving grounds as was done for Shot Annie. No readings above background were found.

3.4.4 A close-in aerial survey of the target area was performed by helicopter. Excellent results were obtained. The data and the grid coordinates used are shown in Incl. 19, Chap. 3, of WT-702(REF.).

3.5 LOGISTICS AND SUPPLY

3.5.1 During this period, the Supply Section issued 97 pairs of booties, 118 protective caps, 131 coveralls, 122 pairs of gloves (cotton), 296 protective goggles, and 113 respirators. The laundry serviced 290 pairs of booties, 146 protective caps, 363 coveralls, 1,051 gloves (cotton), 104 respirators, 52 sheets, and 88 towels.

3.5.2 Instruments on hand at the start of this period were 262 T1B's, 90 MX-5's, 85 389A's, 73 PDR39's, 2 Pee Wee No. 211's, 27 chargers (dosimeter), 4 alpha counters No. 955, and 14 recorders, Esterline-Angus. During the period, 139 instruments were issued, 83 were turned in, and 129 were calibrated.

3.5.3 Three trucks, $\frac{1}{4}$ ton CPW; 7 trucks, $\frac{1}{4}$ ton M38; 6 trucks, $\frac{3}{4}$ ton M37; 5 apparatus decon. M3A2; 1 truck, $2\frac{1}{2}$ ton 6 × 6 (Lab); and 1 trailer, 1 ton, 2 wheel, received general service from the maintenance section. Thirty-four vehicles were lubricated and received weekly maintenance. Six vehicles were deadlined and repaired.

3.5.4 All military vehicles were modified by the addition of a 6-volt generator, regulator, ammeter, and a large fan belt. This was done by AEC Communications to improve operation of the radios.

3.6 GENERAL

The Rad-Safe data were presented in a satisfactory manner. Communications, although better in general than in the previous shot, did cause some delay.

[redacted]

UNCLASSIFIED

The Lincoln Mine data caused some anxiety until it was definitely determined that the maximum had been reached. The external gamma lifetime dose did not exceed 3.4 r, and with the population indoors almost immediately after the start of fall-out this value is substantially reduced. The gamma decay after the first day follows very closely to the $t^{-1.2}$ decay law. The possibility does exist that considerable amounts of beta radiation could have been received if some of the people at Lincoln Mine had not taken cover. Fall-out particles clinging to the skin, hair, etc., could have caused local beta burns. However, a lineman, Pfc K. R. Frith, who remained out of doors at Lincoln Mine did not receive beta burns.

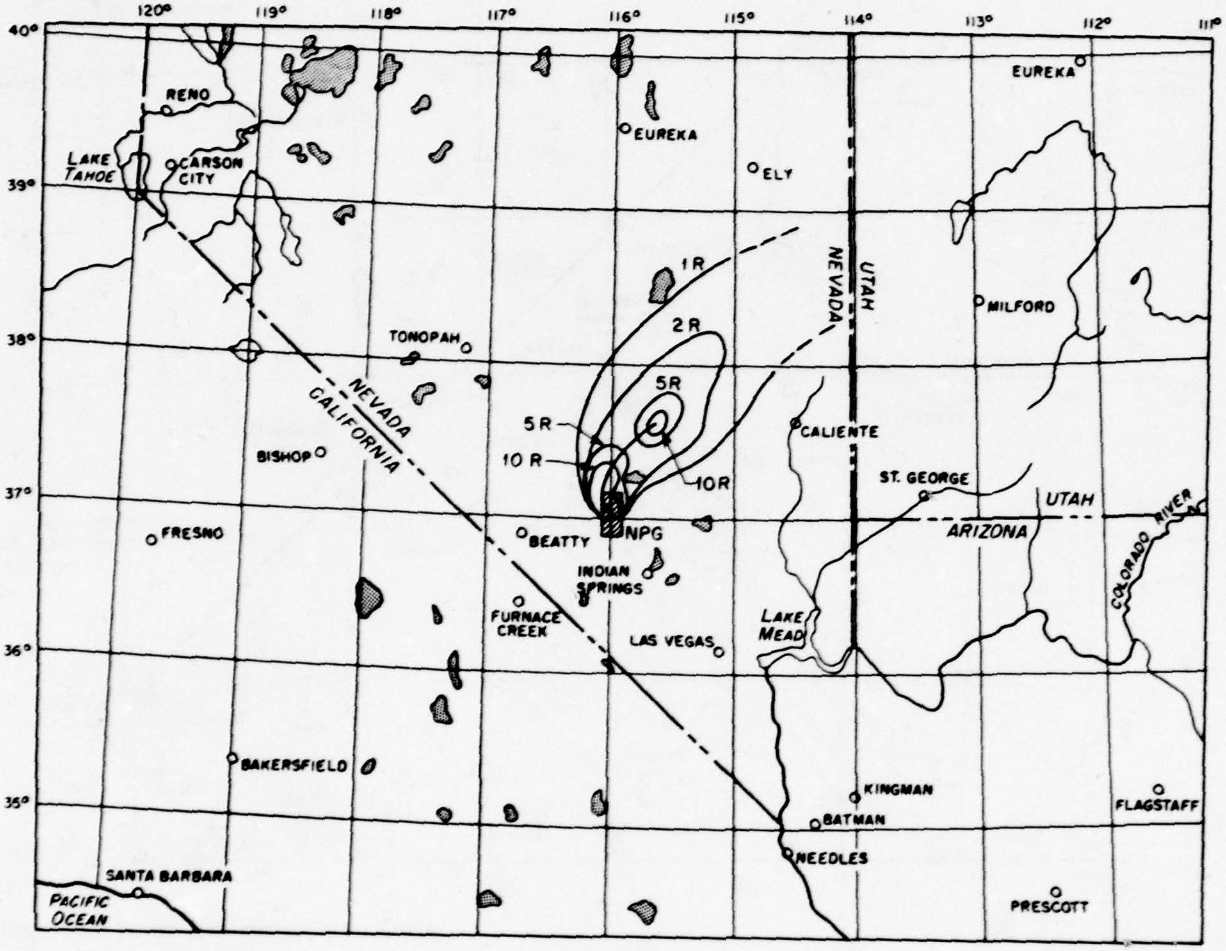
A review of dosage records indicates that monitors are not accumulating dosage at an excessive rate, and that there are sufficient personnel with the reserve personnel at the Chemical Corps Training Command to complete the operation.

[redacted]

UNCLASSIFIED

Inclosure 1

FORECAST FALL-OUT PLOT



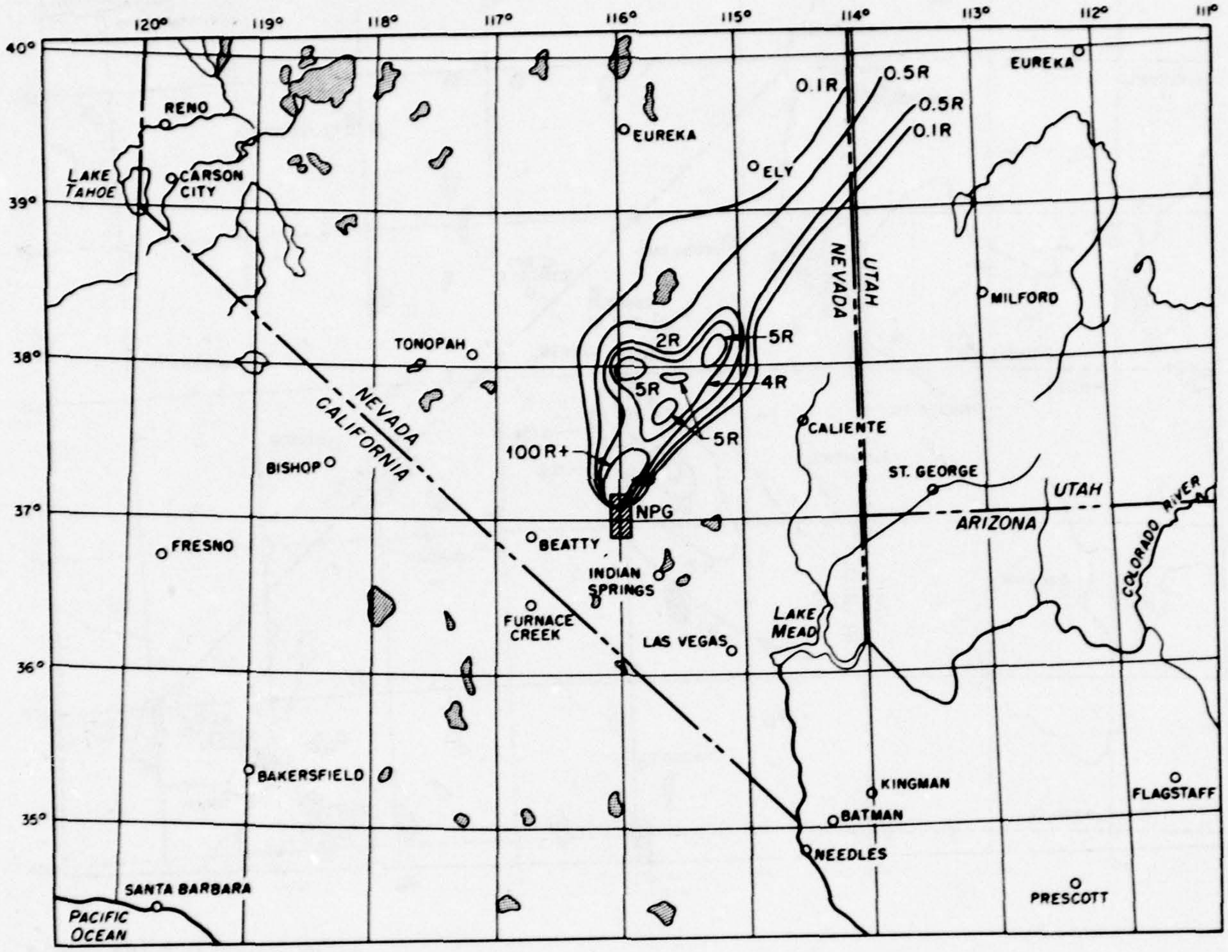
Data based on 0330 winds. Shot Nancy, 24 March 1953. Infinite dose lines are given in roentgens.

[redacted]

UNCLASSIFIED

Inclosure 2

INFINITE DOSE FALL-OUT PATTERN



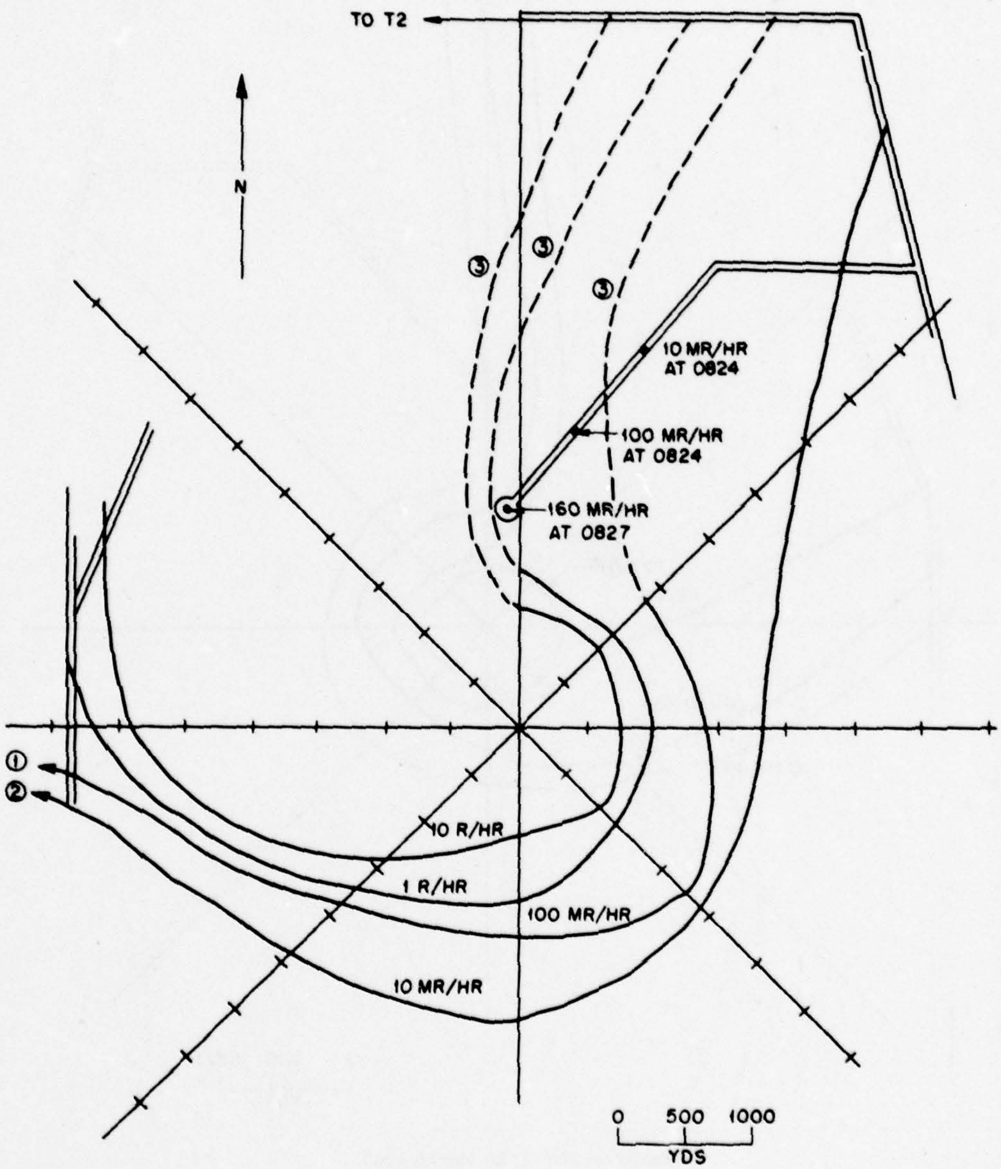
Data based on combined air and ground surveys. Shot Nancy, 24 March 1953.

[redacted]

UNCLASSIFIED

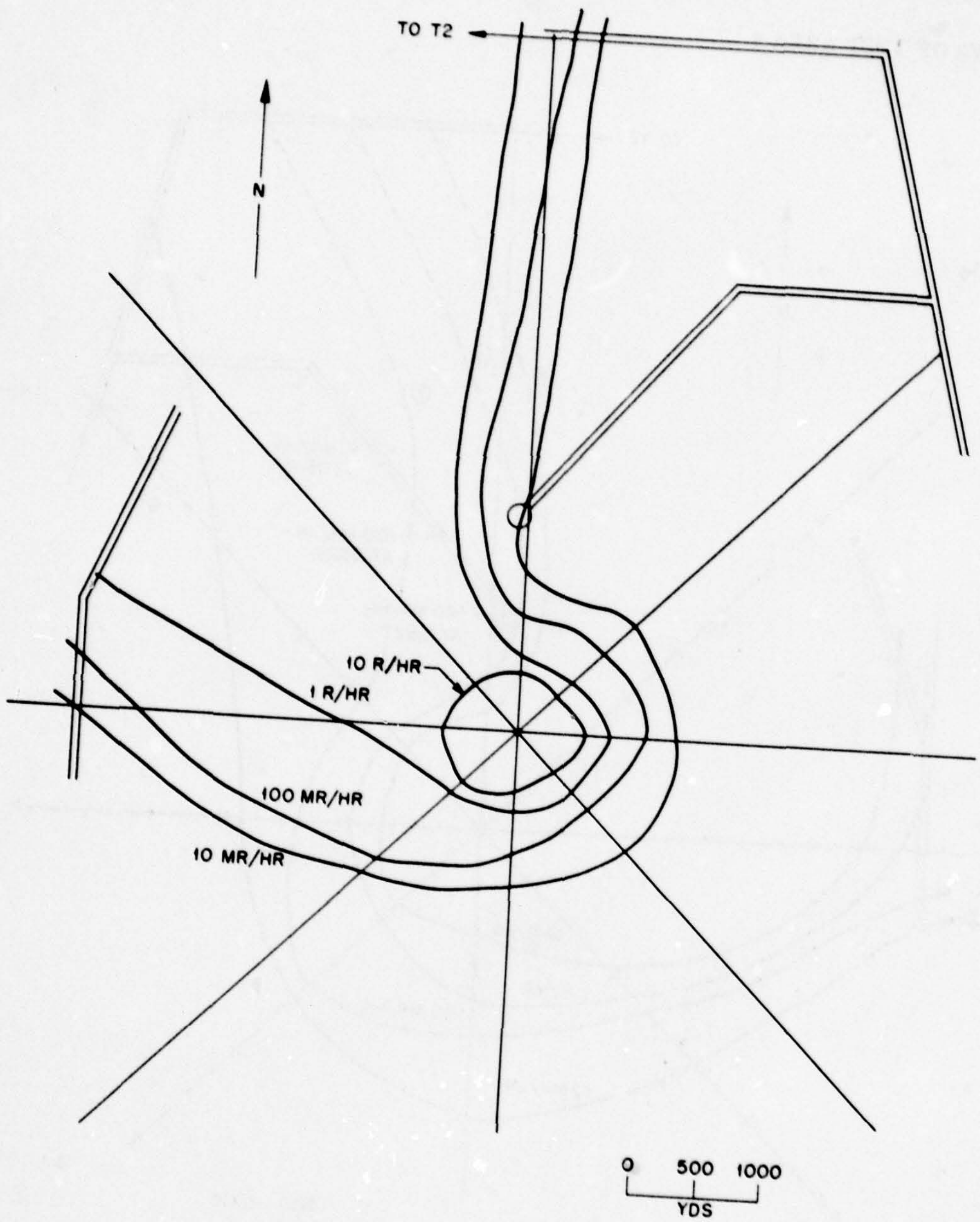
Inclosure 3

SURVEYS OF TEST AREA 4



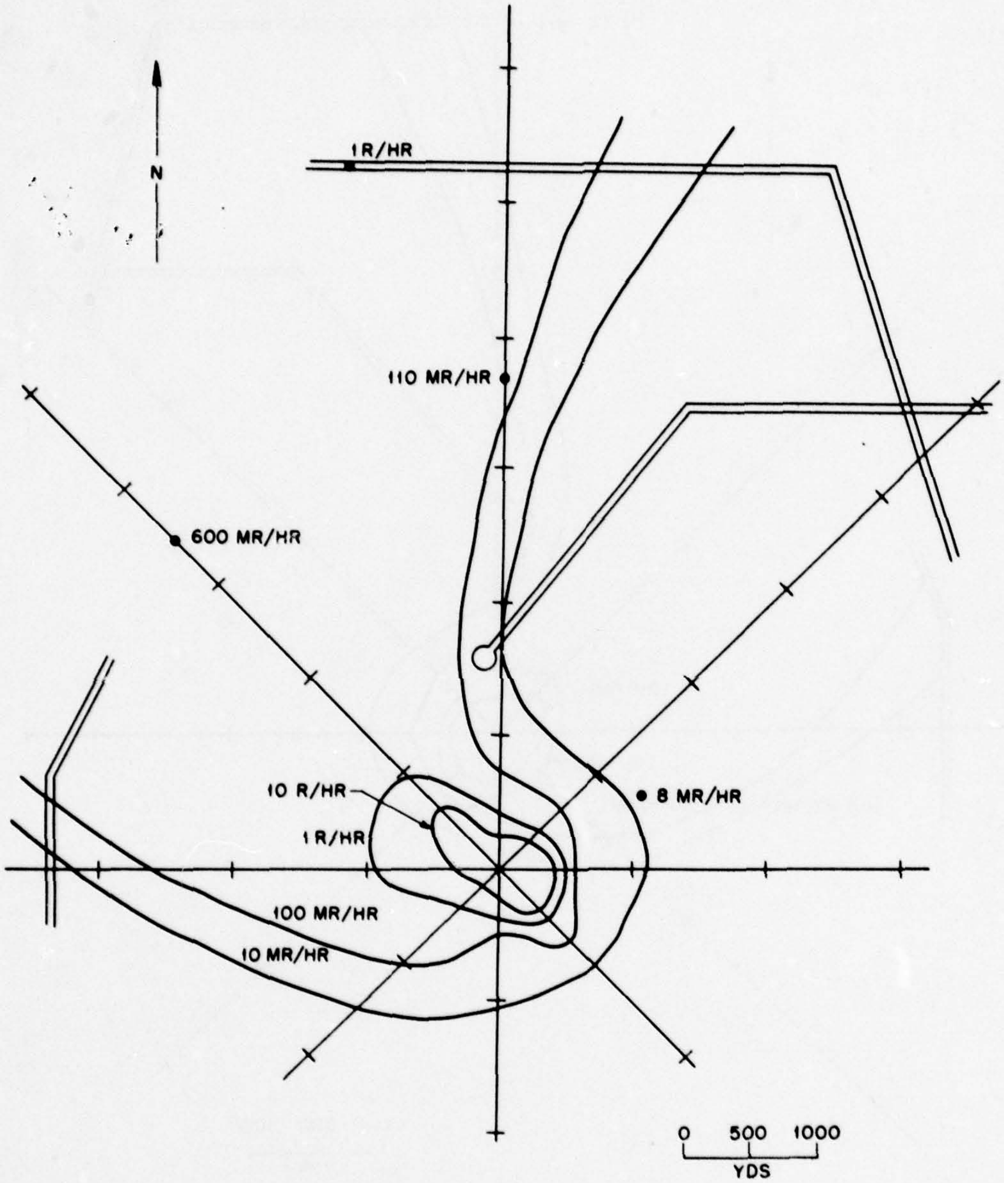
Initial survey, 0610, 24 March 1953. ①, 10 mr/hr line crosses west stake line 6800 yd from GZ. ②, 100 mr/hr line crosses west stake line 4200 yd from GZ. ③, dotted lines are extrapolated from data taken at 0824 to 0827.

[redacted]



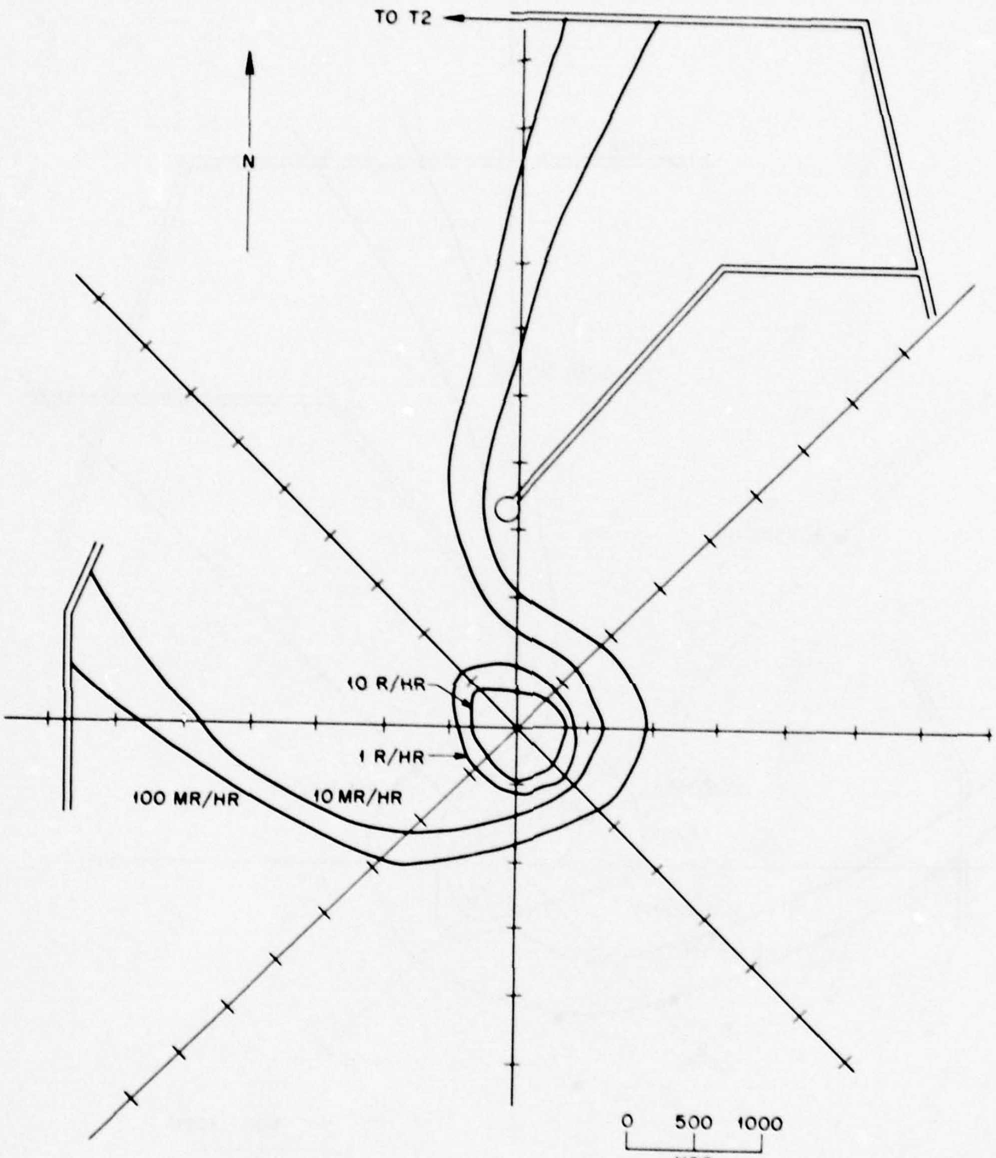
Resurvey, 0730, 25 March 1953.

[redacted]

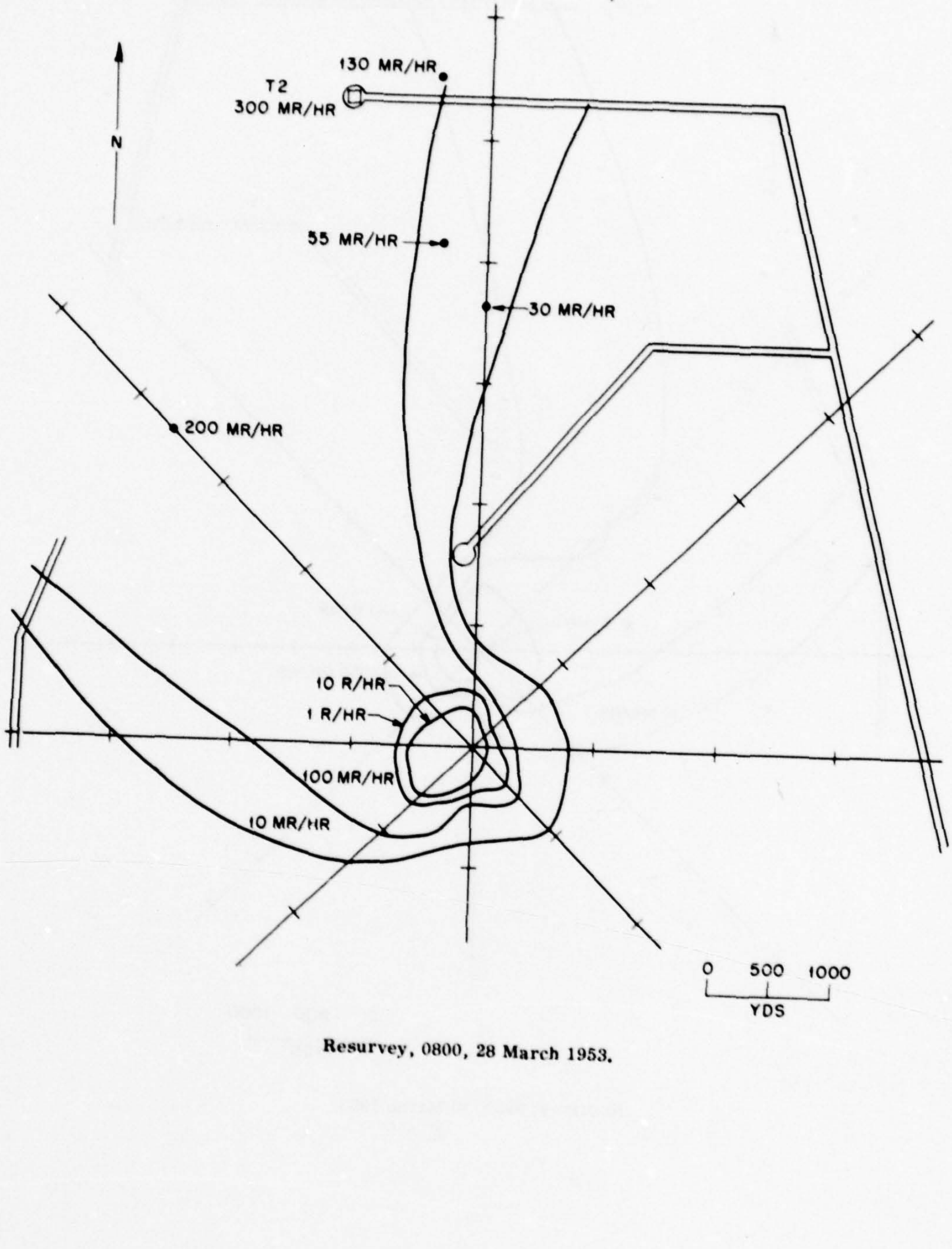


Resurvey, 0630, 26 March 1953.

[redacted]

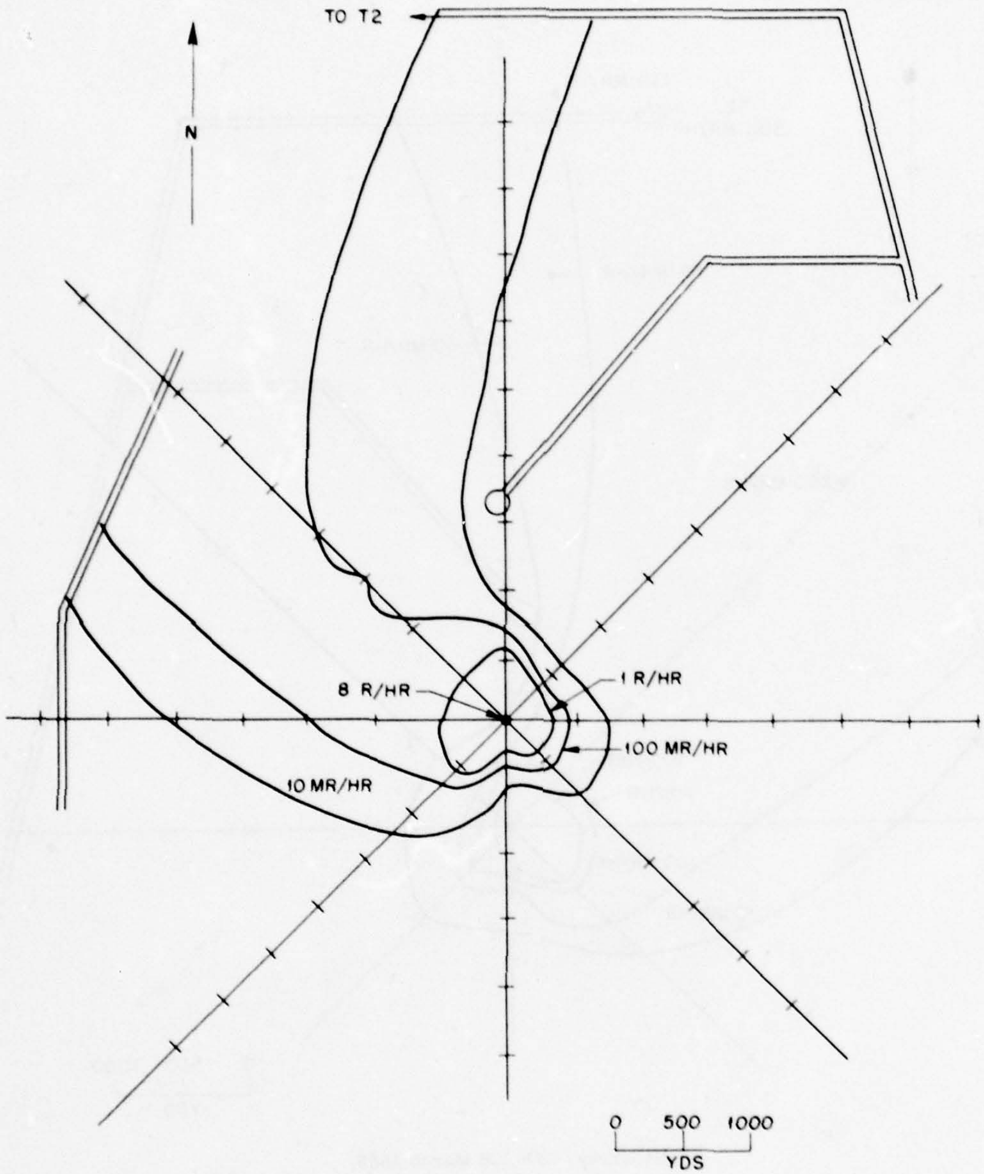


Resurvey, 0830, 27 March 1953.



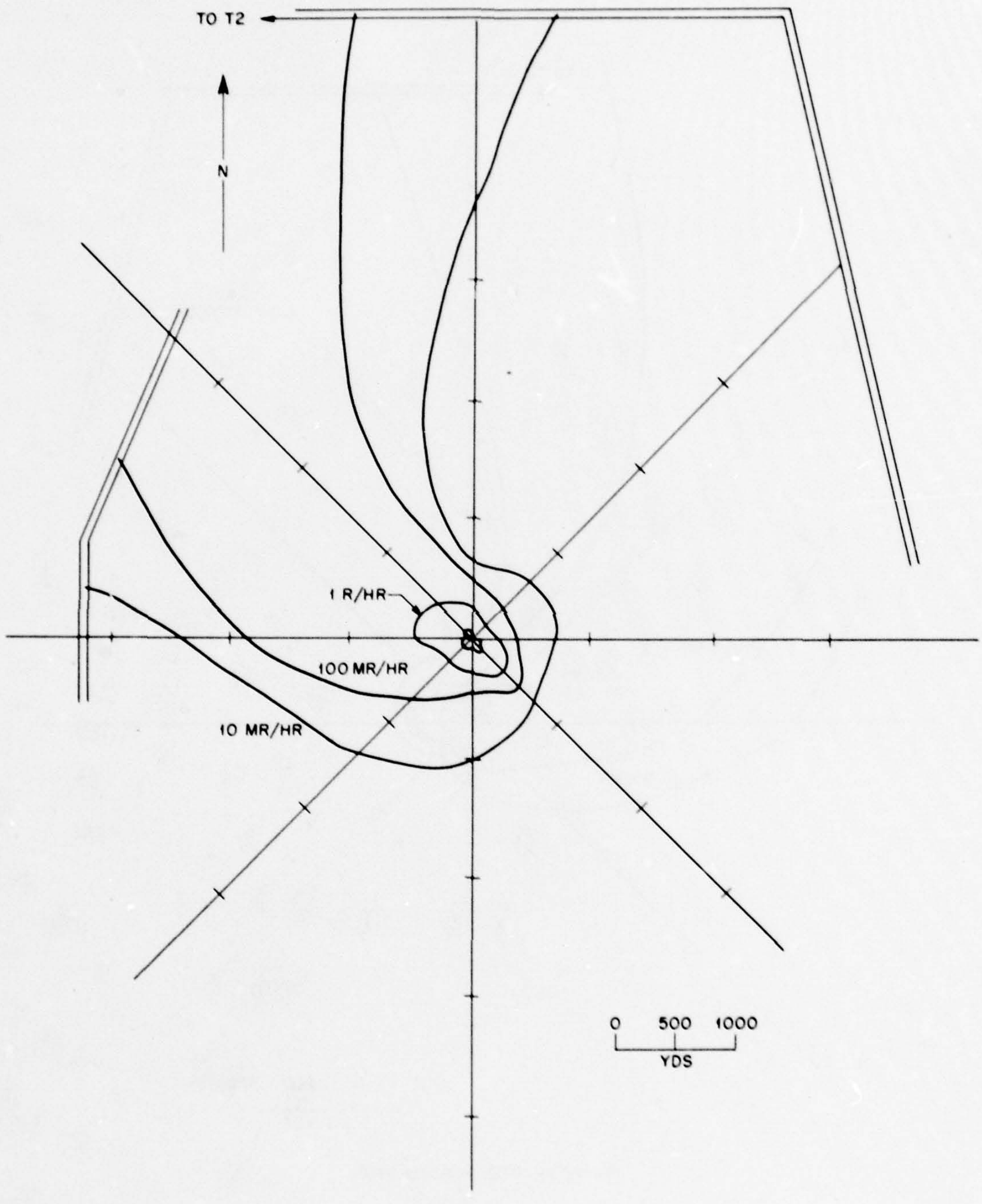
Resurvey, 0800, 28 March 1953.

[redacted]

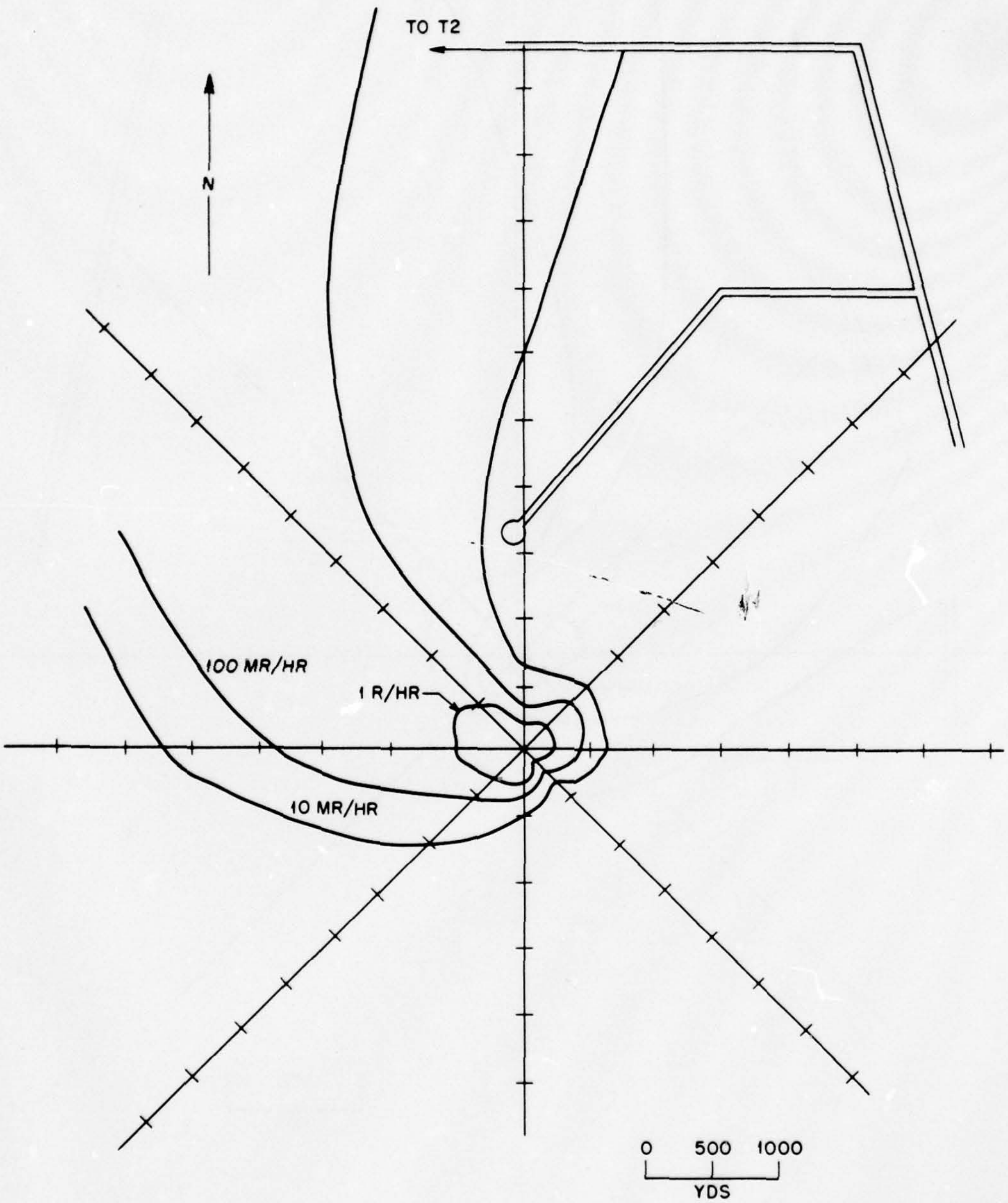


Resurvey, 0930, 30 March 1953.

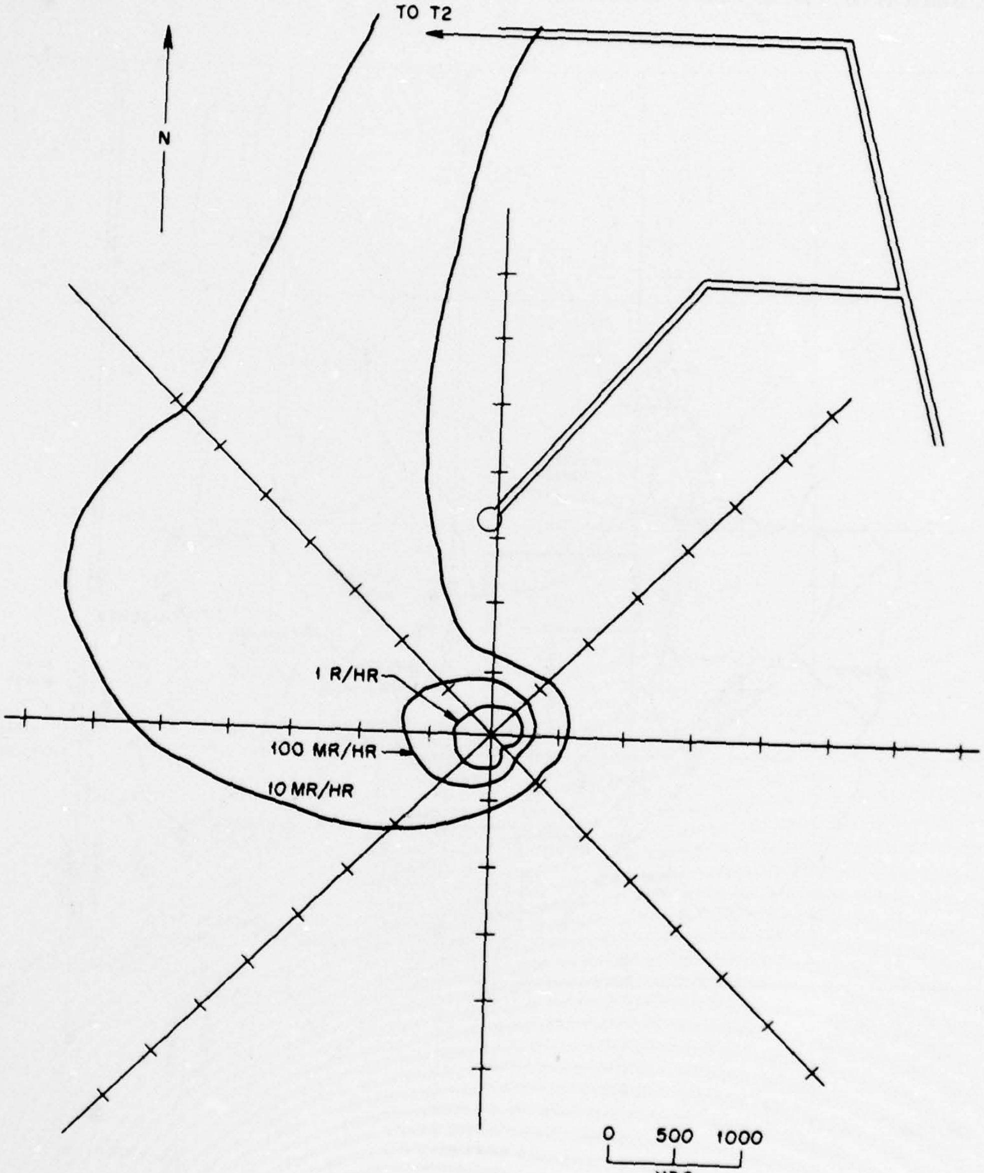
[redacted]



Resurvey, 0630, 1 April 1953.



Resurvey, 0730, 4 April 1953.

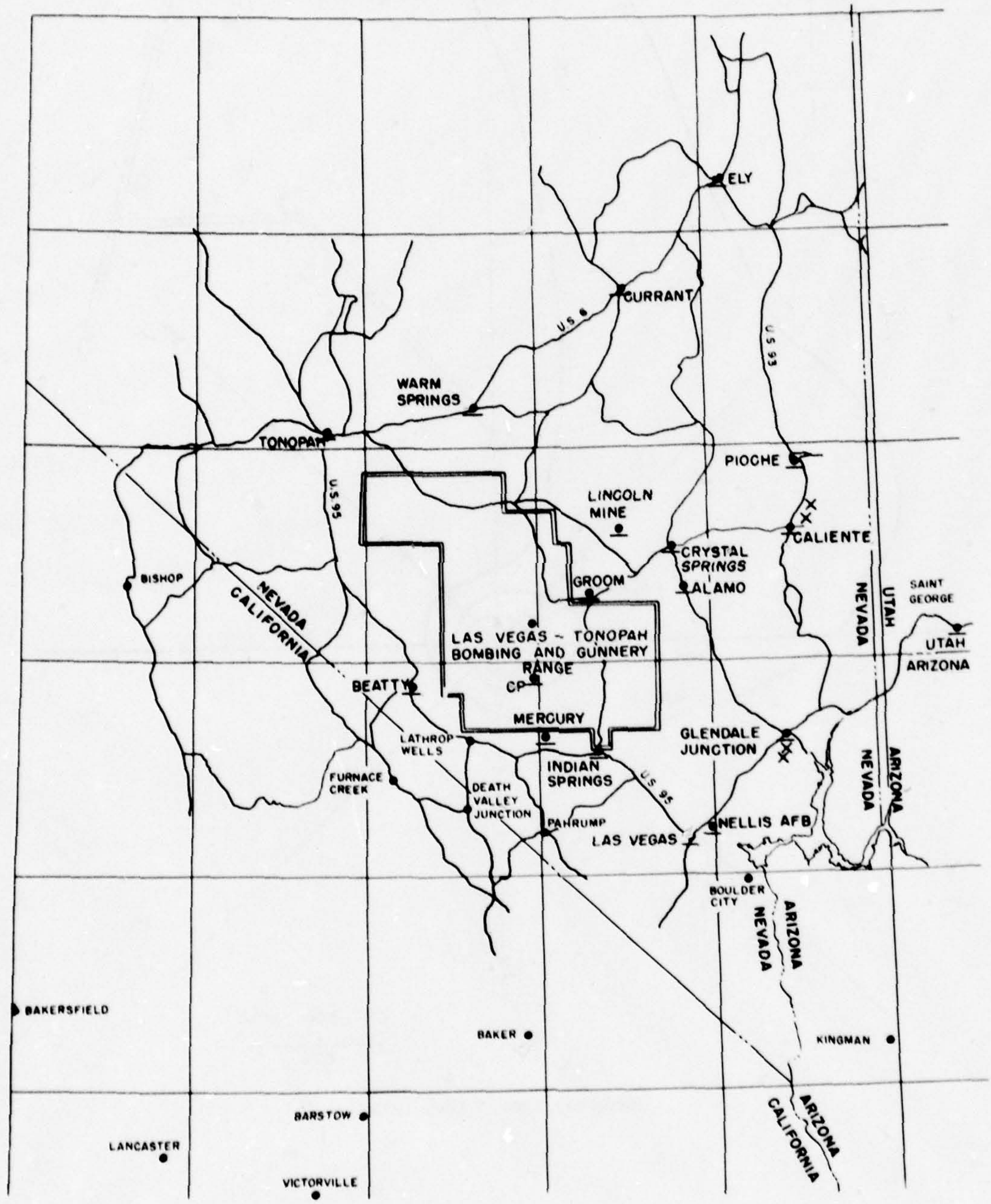


Resurvey, 1200, 7 April 1953.

[redacted]

Inclosure 4

DISTRIBUTION OF FIXED AND MOBILE OFF-SITE MONITORS, D-1, SHOT NANCY



●, fixed stations. ×, mobile monitors.

UNCLASSIFIED

Inclosure 5

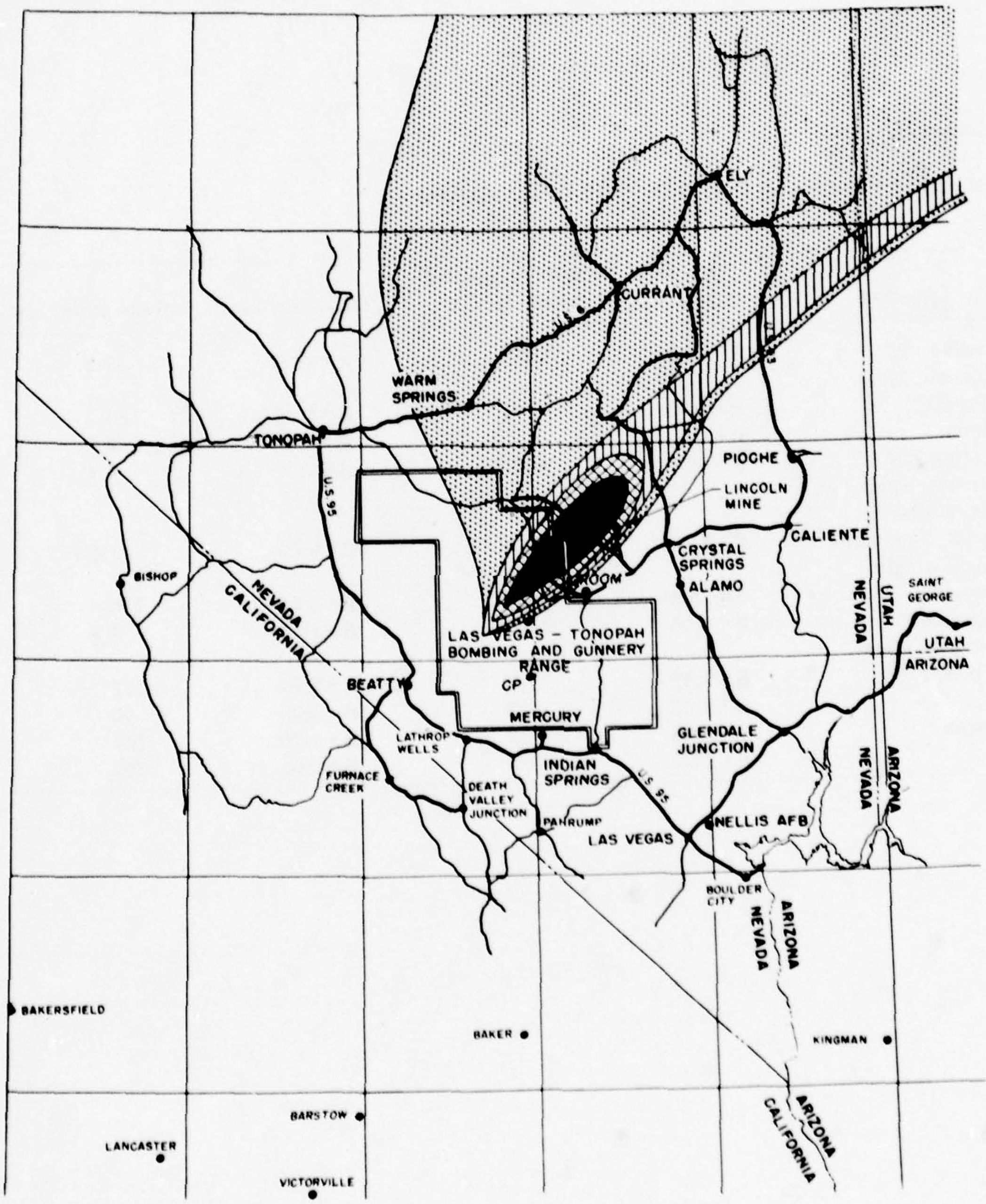
RADIATION DOSES FOR INFINITE TIME OF EXPOSURE

Location	Time of reading	Maximum ground level, mr/hr	Fall-out time	Infinite dose, mr
32 miles SW Lincoln Mine	H + 58:50	32	H + 0:45	23 r
Duckwater	H + 7:05	4	H + 6:00	180
Adaven	H + 7:50		H + 4:30	480
41 miles NW Crystal Springs toward Adaven	H + 5:25	140	H + 4:00	4 r
Hwy 93, 59 miles south of Ely	H + 7:15	45	H + 6:00	1.5 r
Sunnyside	H + 15:15	17	H + 5:00	900
8 miles NW Lincoln Mine	H + 9:00	85	H + 1:40	6 r
Warm Springs	H + 7:44	3	H + 5:00	125
Ely	H + 9:20	2	H + 7:00	90
Preston	H + 9:15	2	H + 6:00	160
Lund	H + 11:55	3	H + 6:00	200

[redacted]

Inclosure 6

GROUND MONITORING RESULTS, SHOT NANCY

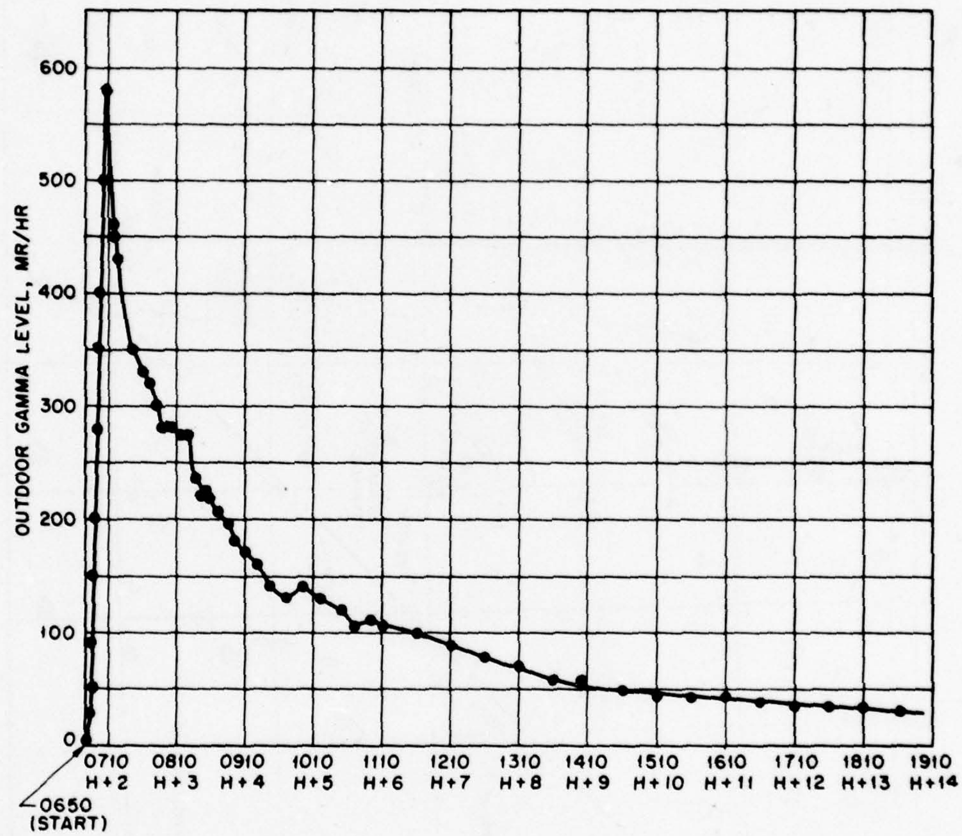


Shot Nancy, spring 1953. ▇▇, 400 mr/hr or above at time of fall-out. ▧▧, 200 to 400 mr/hr at time of fall-out. ▥▥, 20 to 200 mr/hr at time of fall-out. ░░, 2 to 20 mr/hr at time of fall-out. Heavy lines indicate the monitoring runs.

[redacted]
UNCLASSIFIED

Inclosure 7

A PLOT OF INTENSITIES AT LINCOLN MINE



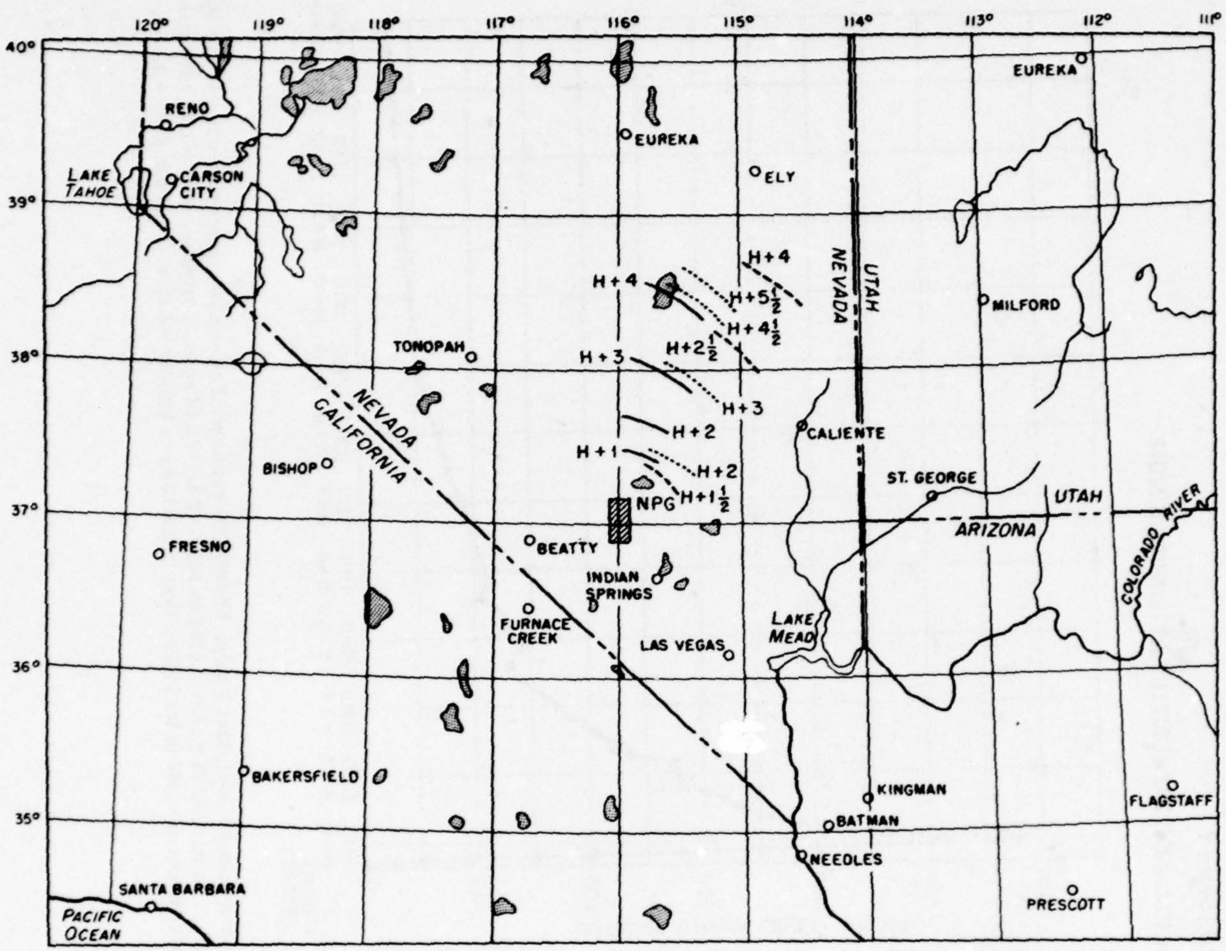
Outdoor gamma level, Shot Nancy. AN/PDR 39 readings. Fall-out commenced at 0650 PST, 24 March 1953. 1 sq in. = 0.167 r. Area (0650 to 1850, 12 hr) = 8.18 sq in. Equivalent dose = 1.36 r for first twelve hours (H + 1:40 to H + 13:40). Dose from 12 hr to infinity = 2.05 r. Total life dose = 3.41 r.

[redacted]

UNCLASSIFIED

Inclosure 8

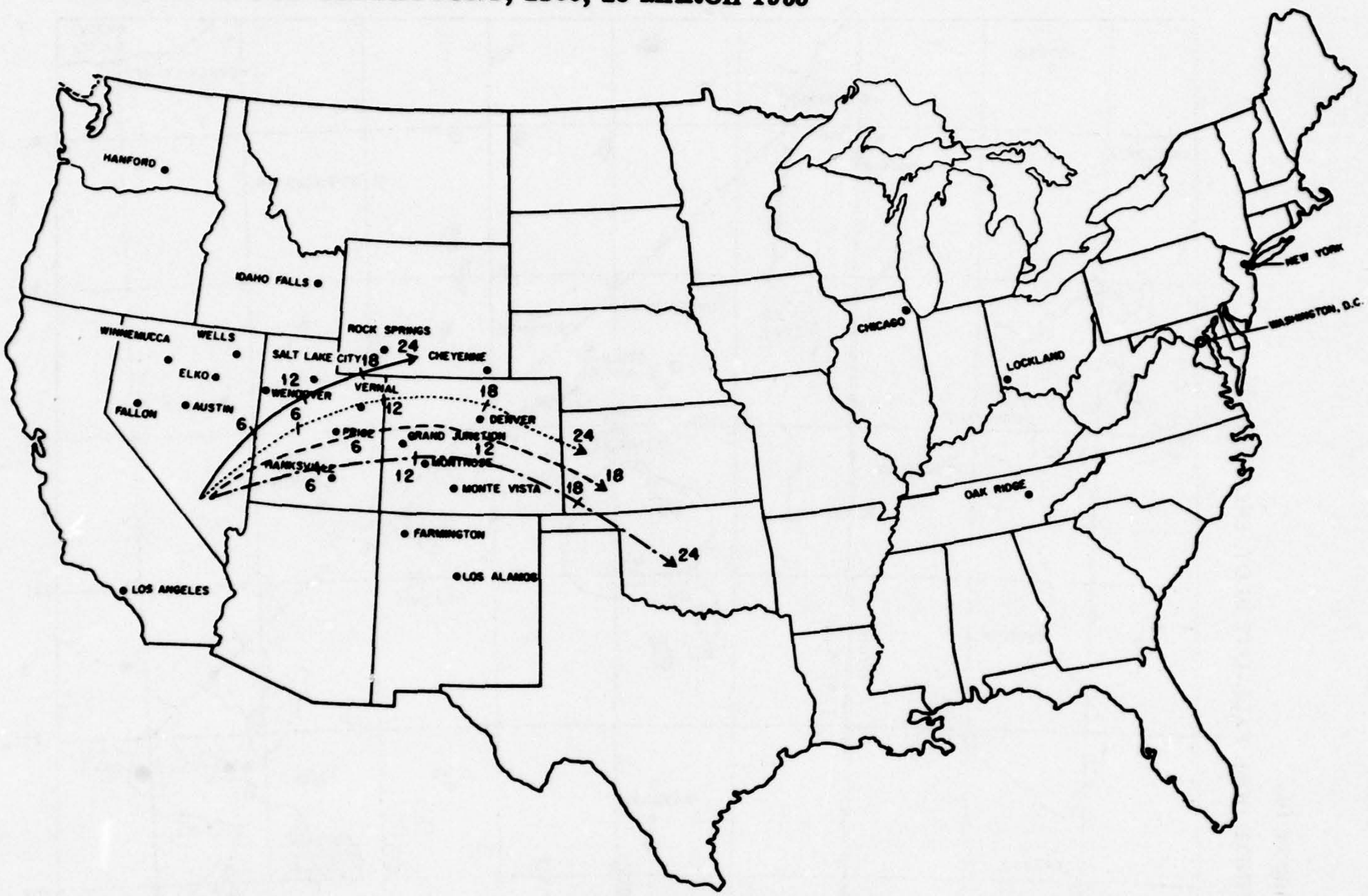
ACTUAL CLOUD TRACK, SHOT NANCY



Cloud position: ——, 12,000 ft msl. ····, 18,100 ft msl. ----, 22,000 to 25,000 ft msl. Cloud top, 41,000 ft msl.

Inclosure 9

PREDICTED CLOUD TRAJECTORY, 2100, 23 MARCH 1953



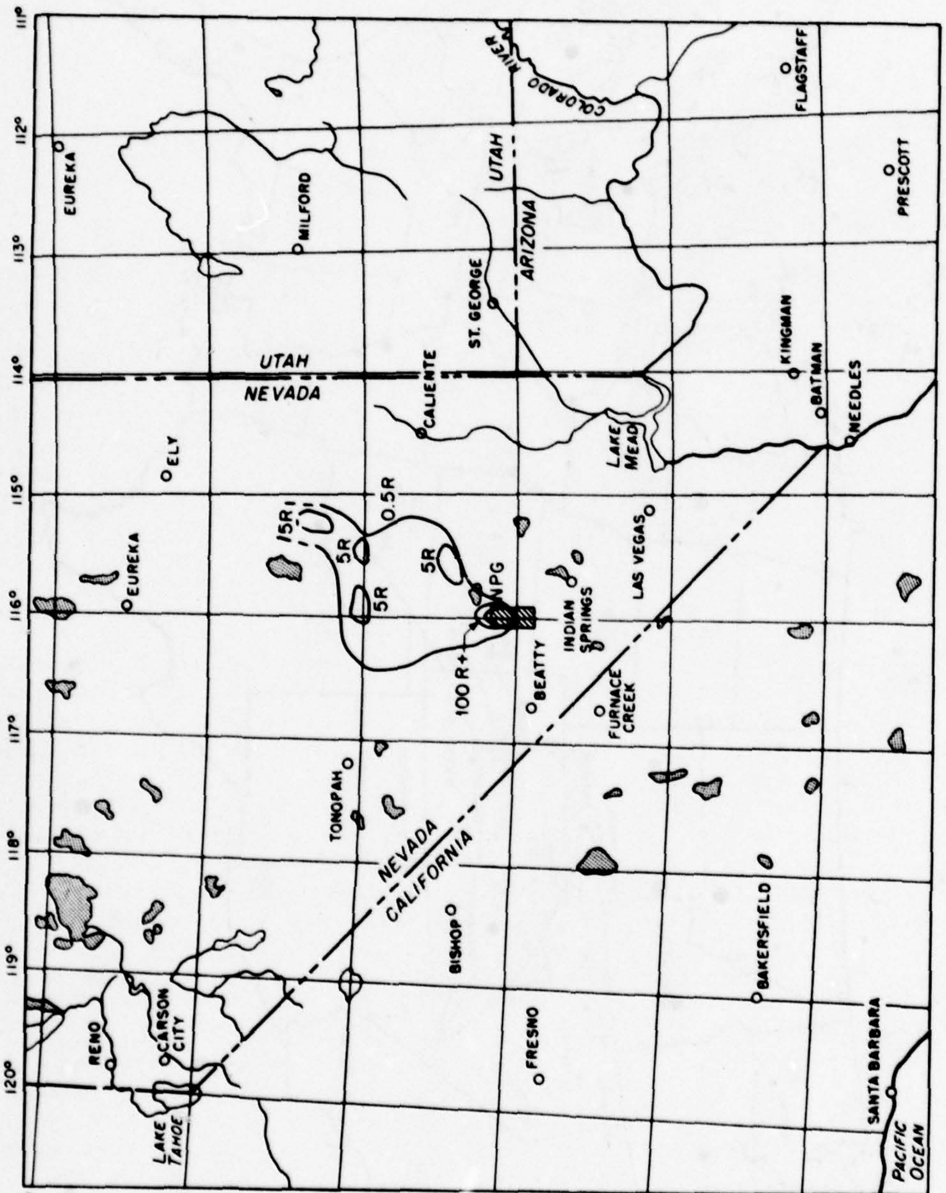
Cloud position: ——, 10,000 ft msl. . . . ., 20,000 ft msl. - - - -, 30,000 ft msl. — . — ., 40,000 ft msl.

[redacted]

UNCLASSIFIED

Inclosure 10

INFINITE DOSE FALL-OUT PLOT, SHOT NANCY



Infinite dose fall-out plot, aerial survey only. Shot Nancy, 24 March 1953.

[redacted]

UNCLASSIFIED

Chapter 4

SHOT RUTH*

4.1 INTRODUCTION

4.1.1 The third shot of the Upshot-Knothole series, Ruth, was detonated on a 300 ft tower in Area 7 of Yucca Flat, NPG, at 0500, 31 March 1953. The decision to fire was made at the 2100-hr weather briefing on 30 March 1953. The decision was made in spite of the fact that the prevailing winds were forecast to be in the direction of Indian Springs and Las Vegas. This decision was justified by the fact that nowhere outside of NPG was any fall-out detected.

4.1.2 The On-Site ground survey started at 0522 and was completed by 0711. Communications were very poor during this survey; however, owing to the small area and low intensities involved, this did not present as great a problem as might have been expected. "R" (general recovery) hour was announced at 0615. Prior to this time three projects had been released by the Test Director.

4.2 ON-SITE OPERATIONS

4.2.1 Two dry runs were conducted on D−4, and one was conducted on D−3. The initial survey for this shot was routine. Ground contamination was less than for any of the previous shots. Subsequent surveys were made daily through 3 April 1953. The initial survey plot and all subsequent plots for Shot Ruth are attached as Incl. 1. Inclosure 2 shows the general radiological situation on 2 April in the Yucca Flat Area as a result of the first three shots.

4.2.2 Communications on Shot Ruth were very poor. Plotting and Briefing was able to hear the survey teams, but transmission to the survey teams was for the most part unreadable. On other days during this period, communications ranged from satisfactory to very poor.

4.2.3 No particular problems with regard to monitoring were experienced owing to the small size of the contaminated area. However, valuable experience was gained since the survey teams took readings too early and a change in the fall-out pattern was noted when later readings were taken. The first reading for the initial survey for this shot was at 0522, 22 min after shot time.

4.2.4 Two hundred ninety-seven (297) persons in seventy-three (73) parties were briefed and cleared for entry into the controlled contaminated areas during this period (30 March through 5 April). Approximately 1200 film badges were processed, and one hundred fifty-two (152) vehicles were decontaminated during the period.

4.2.5 For this shot, "channel markers" were placed at the end of the stake lines to assist the survey teams in finding their designated area. These markers are pyramidal in shape, painted white, and 10 ft high. An additional wash rack with a long ramp was built to replace

* Period covered, 30 March to 4 April 1953.

one of the old unsatisfactory ones. A "Signs" detail was organized to keep all access roads to contaminated areas properly marked with radiation signs. A danger radiation sign was posted at the 10 mr/hr line, and a sign stating "monitor required beyond this point" was posted at the 100 mr/hr iso-intensity line. This was done to reduce the number of check point monitors required for other than main access roads.

4.3 OFF-SITE OPERATIONS

4.3.1 The changes in the anticipated fall-out pattern resulting from this detonation are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Sec. II, WT-705). By shot time the areas of primary interest were Indian Springs and Las Vegas. Off-Site mobile teams and equipment were moved to provide maximum coverage in the communities in the path of fall-out.

4.3.2 Significant ground levels were detected only at the CP and Mercury with these values rapidly returning to normal background. At points other than the above, levels were residual radiation from previous detonations. A documentation of ground monitoring results is given in Incl. 3, Chap. 4, of WT-702(REF.).

4.3.3 Air sampling results provided the only means of following the fall-out pattern in most communities. Levels of the order of 10^{-2} to 10^{-4} $\mu c/M^3$ were considered significant to indicate points of fall-out, as the low level of the fall-out did not permit its detection with survey meters. A tabulation of air concentrations is given in Incl. 4, Chap. 4, of WT-702(REF.). A pictorial presentation of the fall-out pattern was not possible; however the specific locations where fall-out occurred are shown in Incl. 3.

4.3.4 The results of water samples analyzed for fission-product activity are presented in Incl. 6, Chap. 4, of WT-702(REF.).

4.4 AIR PARTICIPATION

4.4.1 Weather information indicated that the radioactive air mass would move in the direction of Indian Springs and Las Vegas. Recommendations were made to close the air space at all altitudes for a radius of 50 miles from ground zero from 0430 to 0630 hr PST on D-day to all except test aircraft. In addition, the air space enclosed by the 90° and 160° vectors from ground zero out to a radius of 150 miles was recommended closed to all except test aircraft at 21,000 ft msl and below from 0630 to 1130 hr on D-day. At H+30 min Amber 2 and all areas east were cleared at all altitudes, as well as at all altitudes above 16,000 ft msl west of Amber 2. A warning area within 180 miles radius of Las Vegas in all directions and at all altitudes below 21,000 ft msl to be effective from 0430 to 1130 hr was recommended.

4.4.2 The cloud tracking aircraft, two B-29's and one B-25, were off from Indian Springs Air Force Base on schedule. The two B-29's were released and returned to base as the cloud had reached its maximum height of 14,300 ft msl. The B-25 tracked the cloud at 12,000 ft msl. The data it reported are given as Incl. 7, Chap. 4, of WT-702(REF.). These data are plotted and presented in Incl. 4. Inclosure 5 shows the predicted cloud trajectory. The procedure for tracking remained the same as for previous shots. The last position of the cloud was given by a sampler aircraft as over the south portion of Lake Mead. The maximum radiation intensity in the cloud was 50 mr/hr (at H + 4½ hr).

4.4.3 The close-in aerial survey was performed by helicopter. It was off from Mercury at H+2 min and performed its mission in a highly satisfactory manner. Data from this flight are shown as Incl. 10, Chap. 4, of WT-702(REF.).

4.4.4 The extended survey was performed by an L-20 and a C-47 aircraft. Communications were generally good, but the data were negative except for two readings obtained by the L-20 near ground zero. The L-20 data are included as Incl. 11, Chap. 4, of WT-702(REF.); the C-47 data are given in Incl. 12, Chap. 4, of WT-702(REF.). No plot was made of the data

as negative results are indicated throughout. No D + 1 day aerial survey was made.

4.5 LOGISTICS AND SUPPLY

4.5.1 For the period of 30 March to 3 April, the Supply Section issued 131 shoe covers, 95 protective caps, 153 coveralls, 105 pairs of cotton gloves, 187 high intensity goggles, 17 protective goggles, and 80 respirators. The laundry serviced 204 shoe covers, 66 protective caps, 196 coveralls, 112 pairs of gloves, 69 respirators, 31 pillowcases, 62 sheets, and 63 towels. The Instrument Repair Section repaired 37 instruments and recalibrated 6 instruments. Fifty-five (55) radiac instruments were issued during this period. Second echelon maintenance was performed on 22 vehicles. Two vehicles were deadlined.

4.6 GENERAL

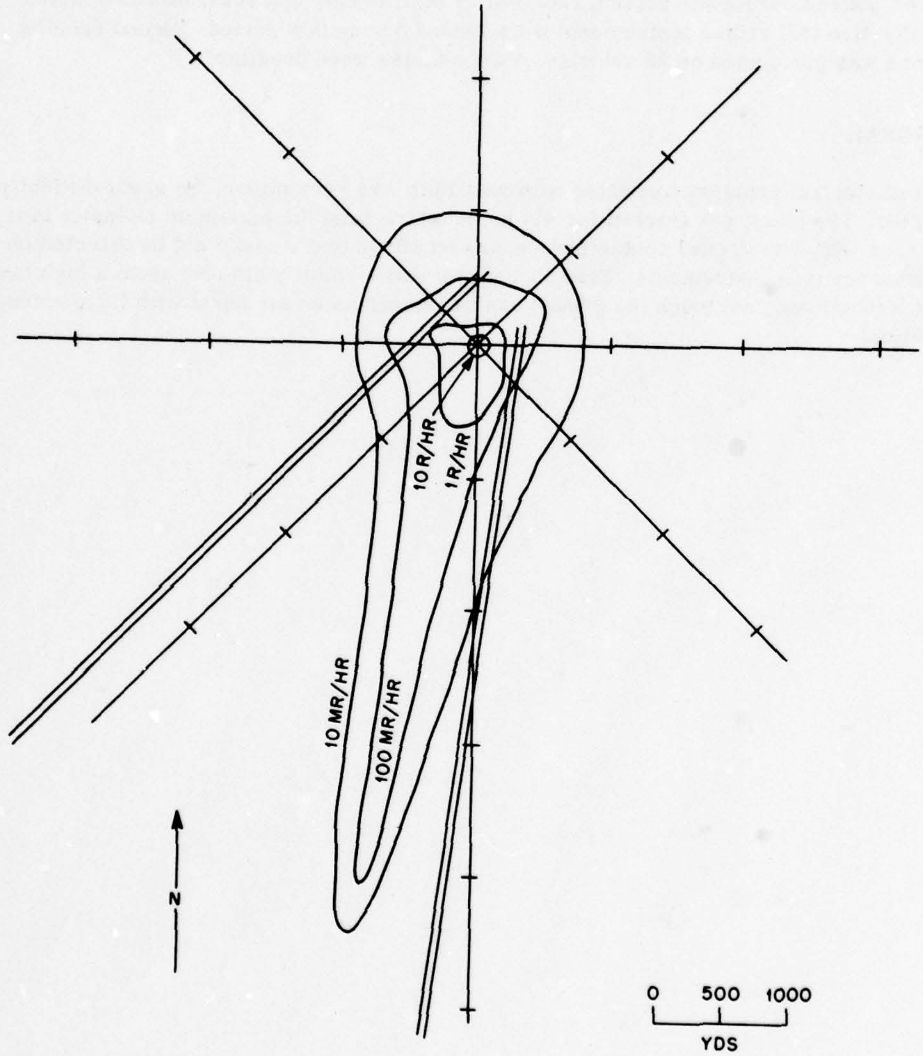
The radiological problem connected with shot Ruth was very minor. No great difficulty was expected. The cloud was tracked for $4\frac{1}{2}$ hr, at which time the maximum intensity in it was 50 mr/hr. Off-Site ground contamination was so minor that it could not be detected on the ground by survey type instruments. This shot shows that a small yield shot from a high tower where the fireball does not touch the ground can be treated as an air burst with little extended contamination.

[redacted]

UNCLASSIFIED

Inclosure 1

SURVEYS OF TEST AREA 7



Initial survey, 0600, 31 March 1953, Test Area 7-5A (H-hour, 0500).

AD A073471

DDC ACCESSION NUMBER

II

LEVEL

DATA SHEET

PHOTOGRAPH

THIS SHEET

1

INVENTORY

WT-817

DOCUMENT IDENTIFICATION

DISTRIBUTION STATEMENT A

Approved for public release;

Distribution Unlimited

DISTRIBUTION STATEMENT

Accession For	
NTIS GRA&I	☒
DDC TAB	☐
Unannounced	☐
Justification per Doc.	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or special
A	

DISTRIBUTION STAMP

DDC

RECEIVED

SEP 5 1979

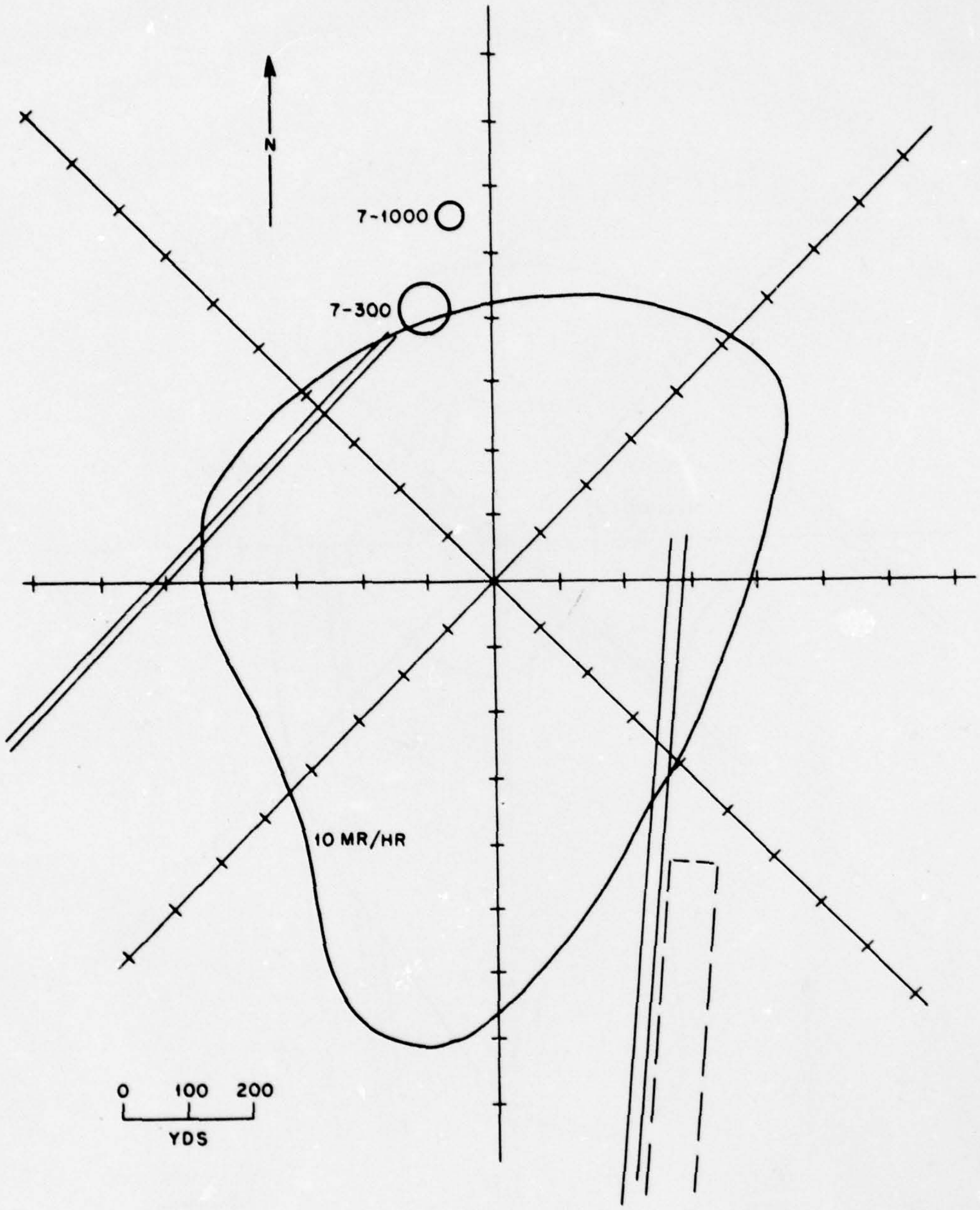
E

DATE ACCESSIONED

79 08 21 044

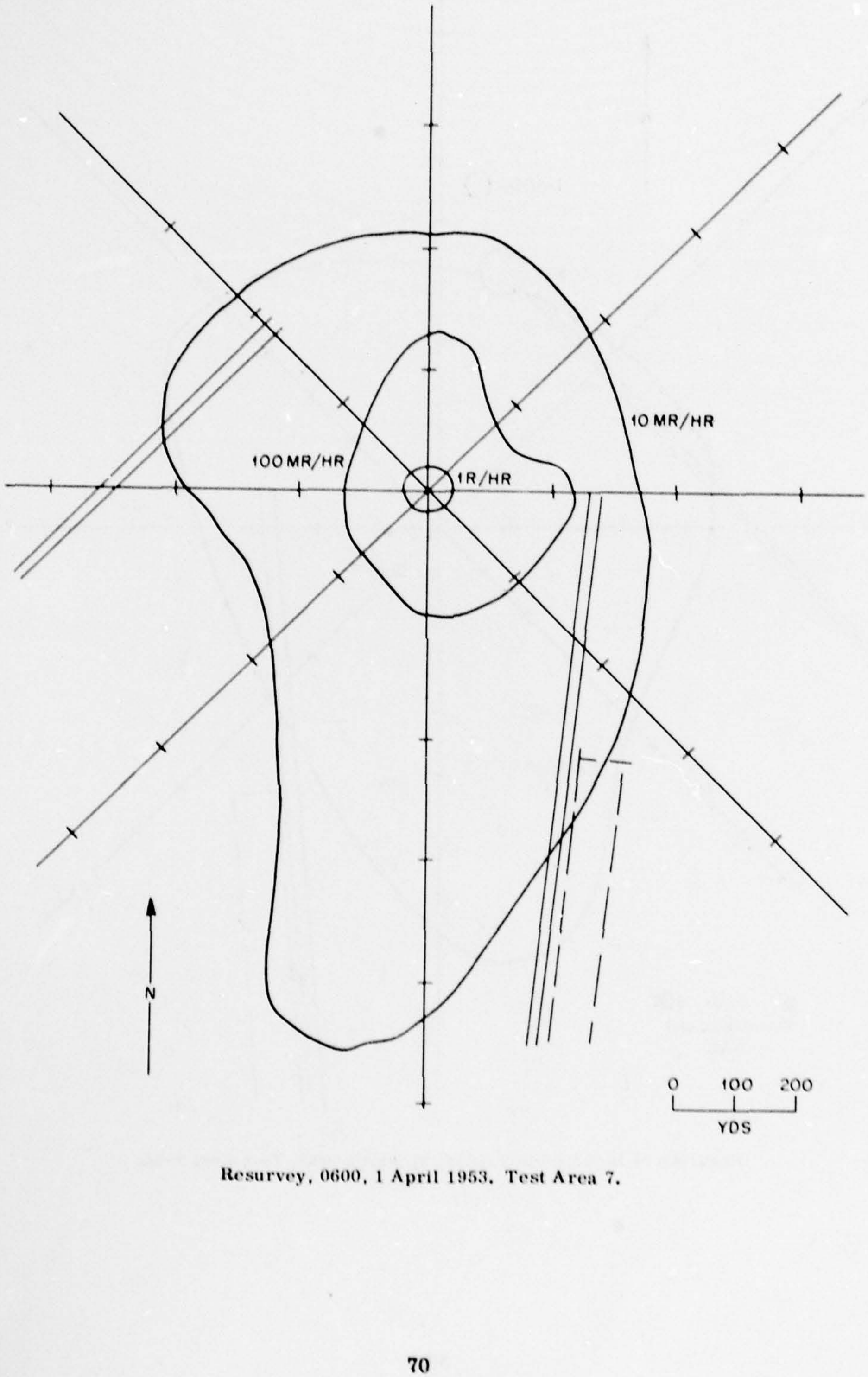
DATE RECEIVED IN DDC

PHOTOGRAPH THIS COPY



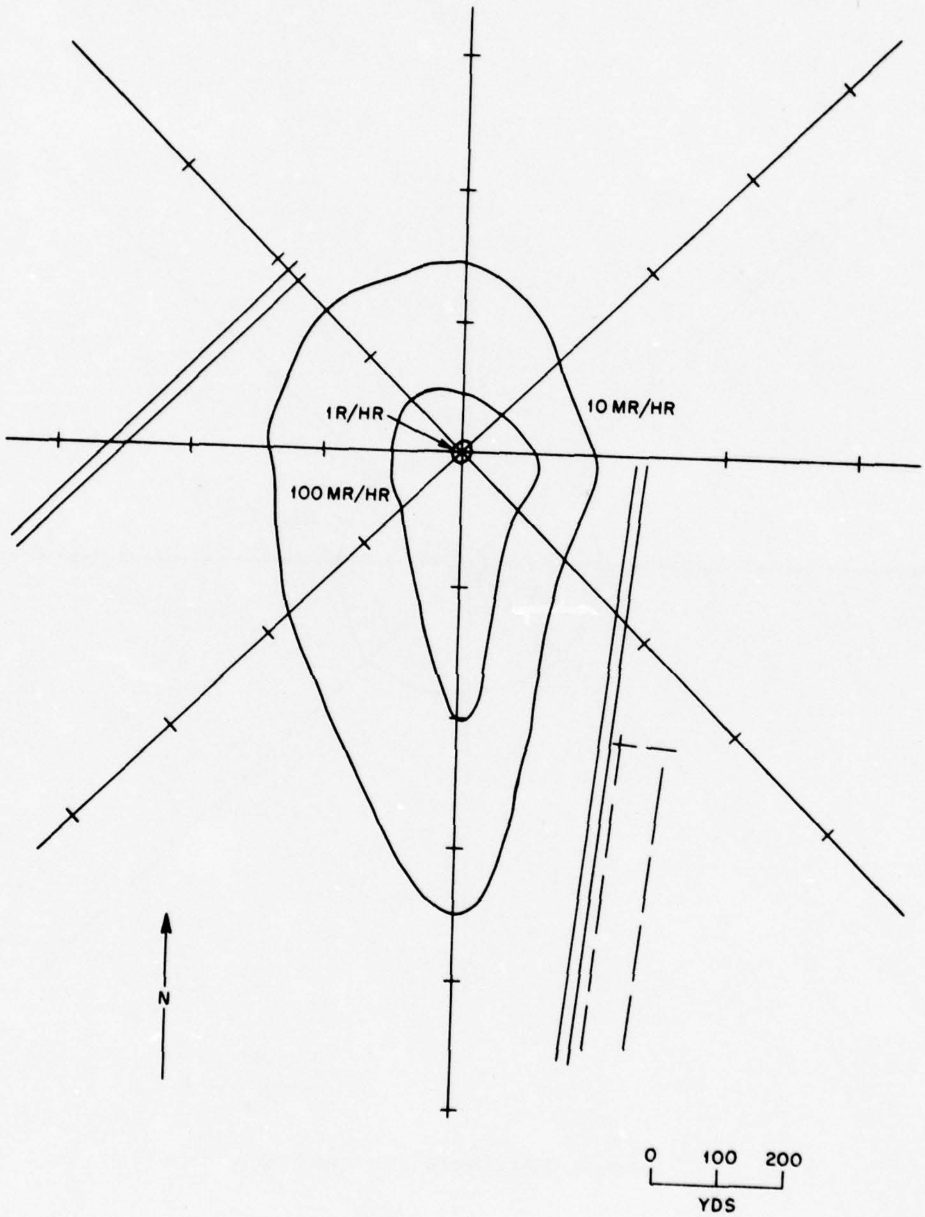
Resurvey of 10 mr/hr line, 1515, 31 March 1953, Test Area 7-5A.

[redacted]



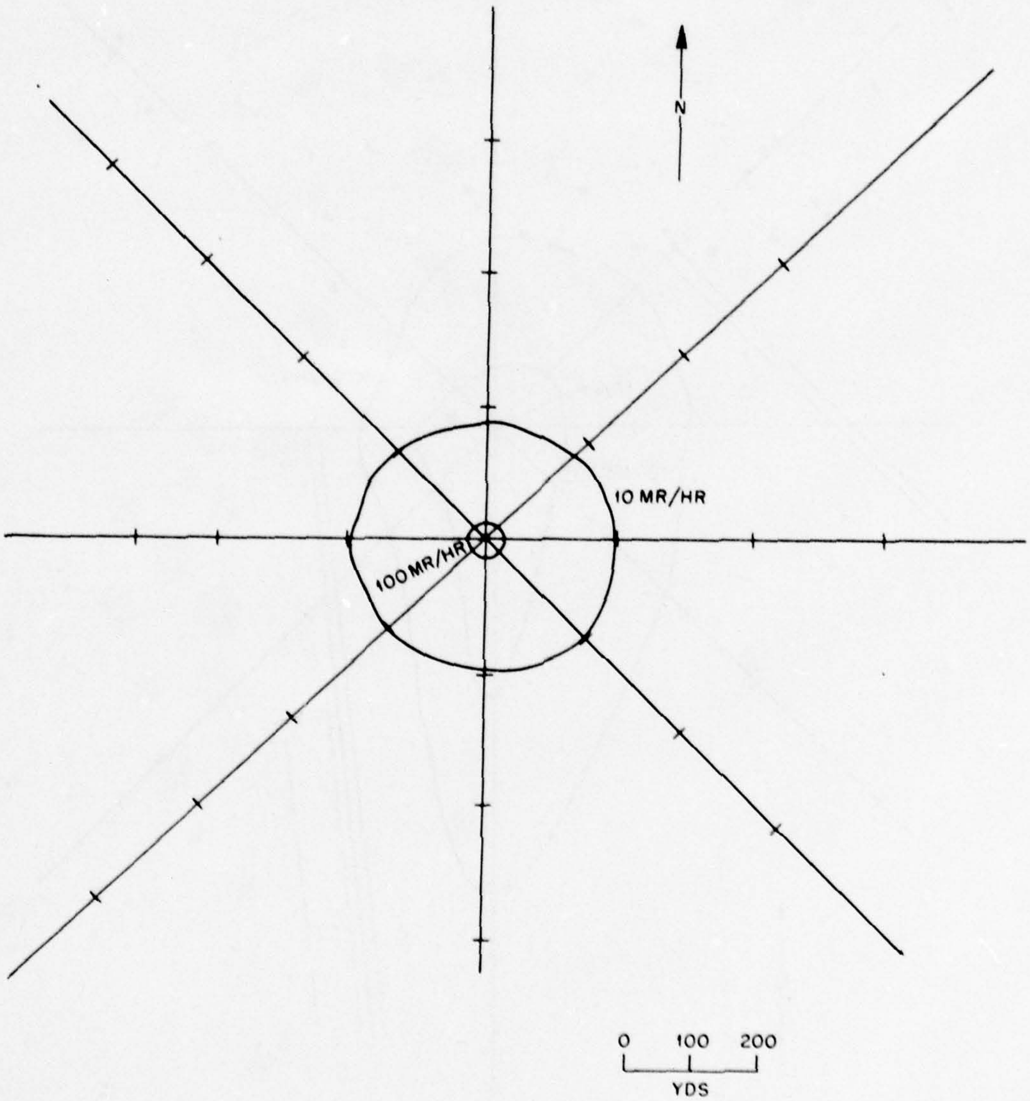
Resurvey, 0600, 1 April 1953. Test Area 7.

[redacted]



Resurvey, 0700, 2 April 1953. Test Area 7.

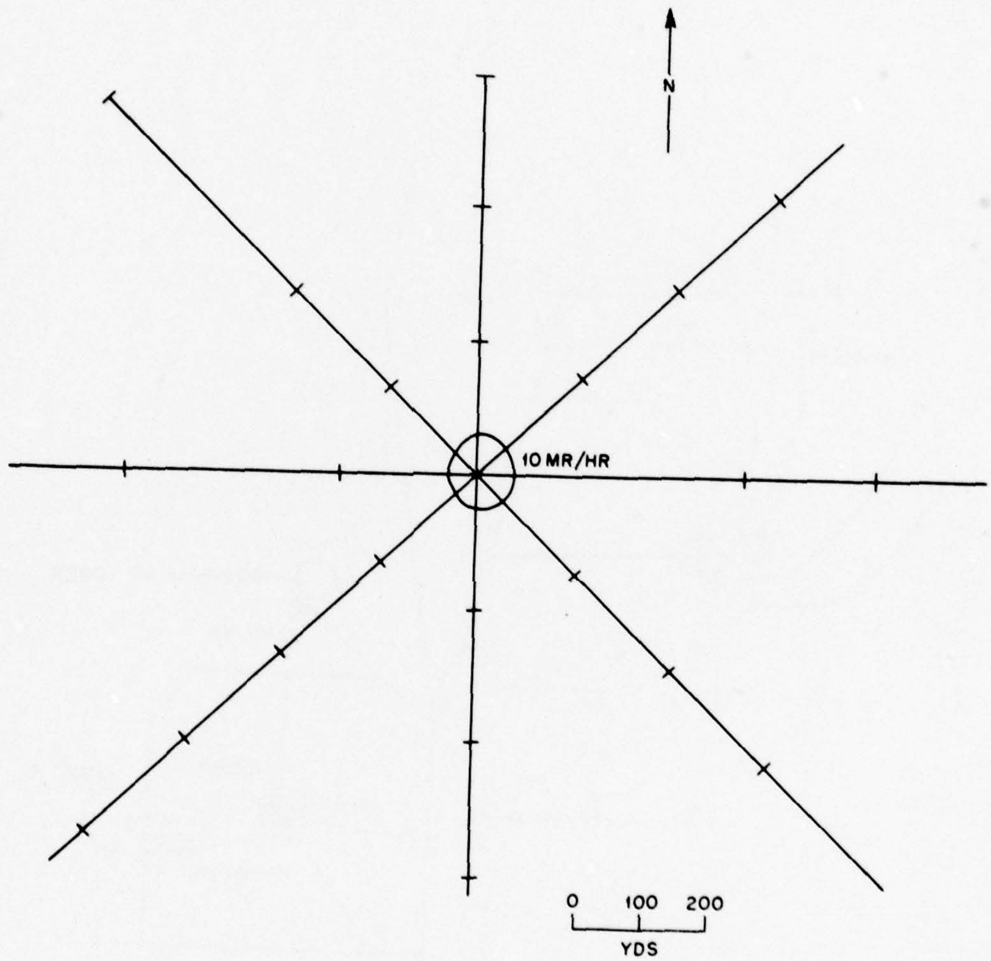
[redacted]



Resurvey, 0600, 3 April 1953. Test Area 7.

[redacted]

UNCLASSIFIED



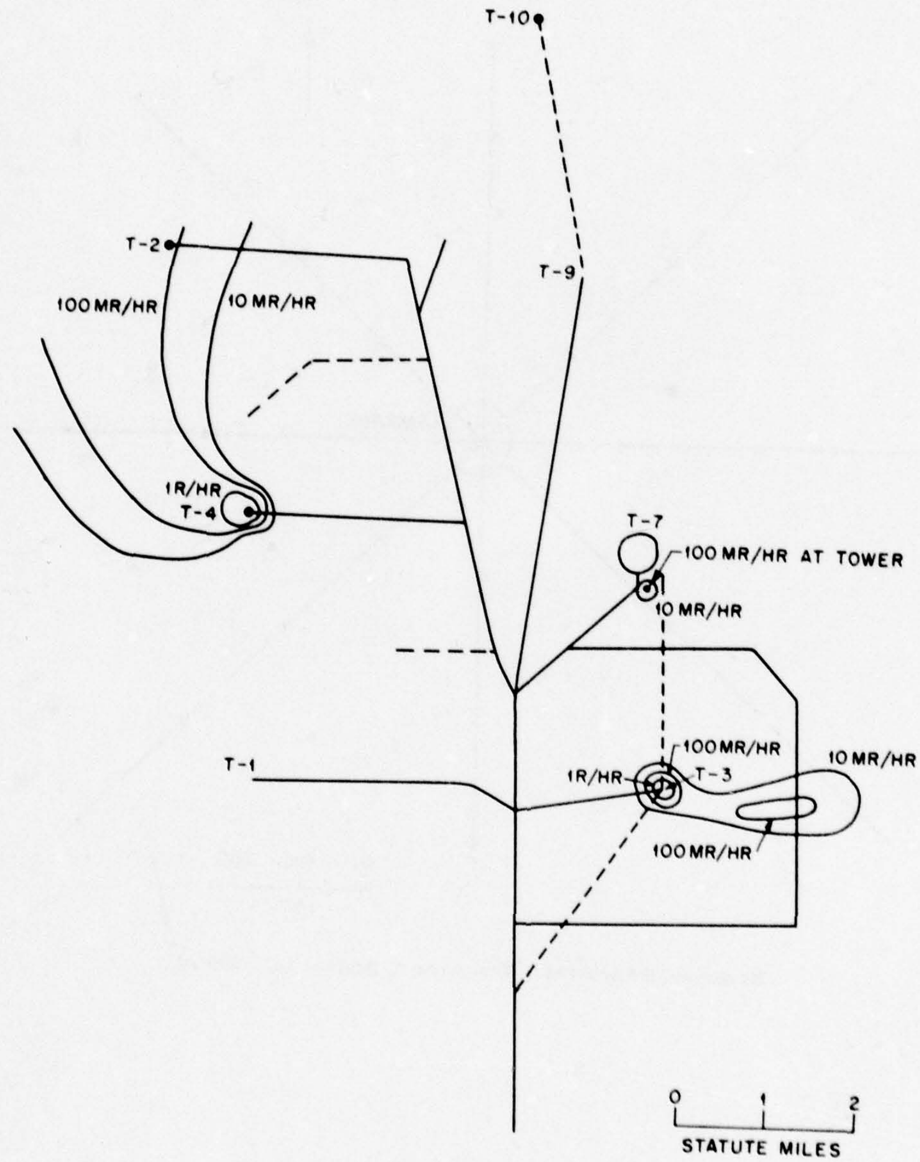
Resurvey, 9 April 1953. Test Area 7. Scale, 1 in. = 200 yd.

[redacted]

UNCLASSIFIED

Inclosure 2

YUCCA FLAT RADIOLOGICAL SITUATION, 2 APRIL 1953



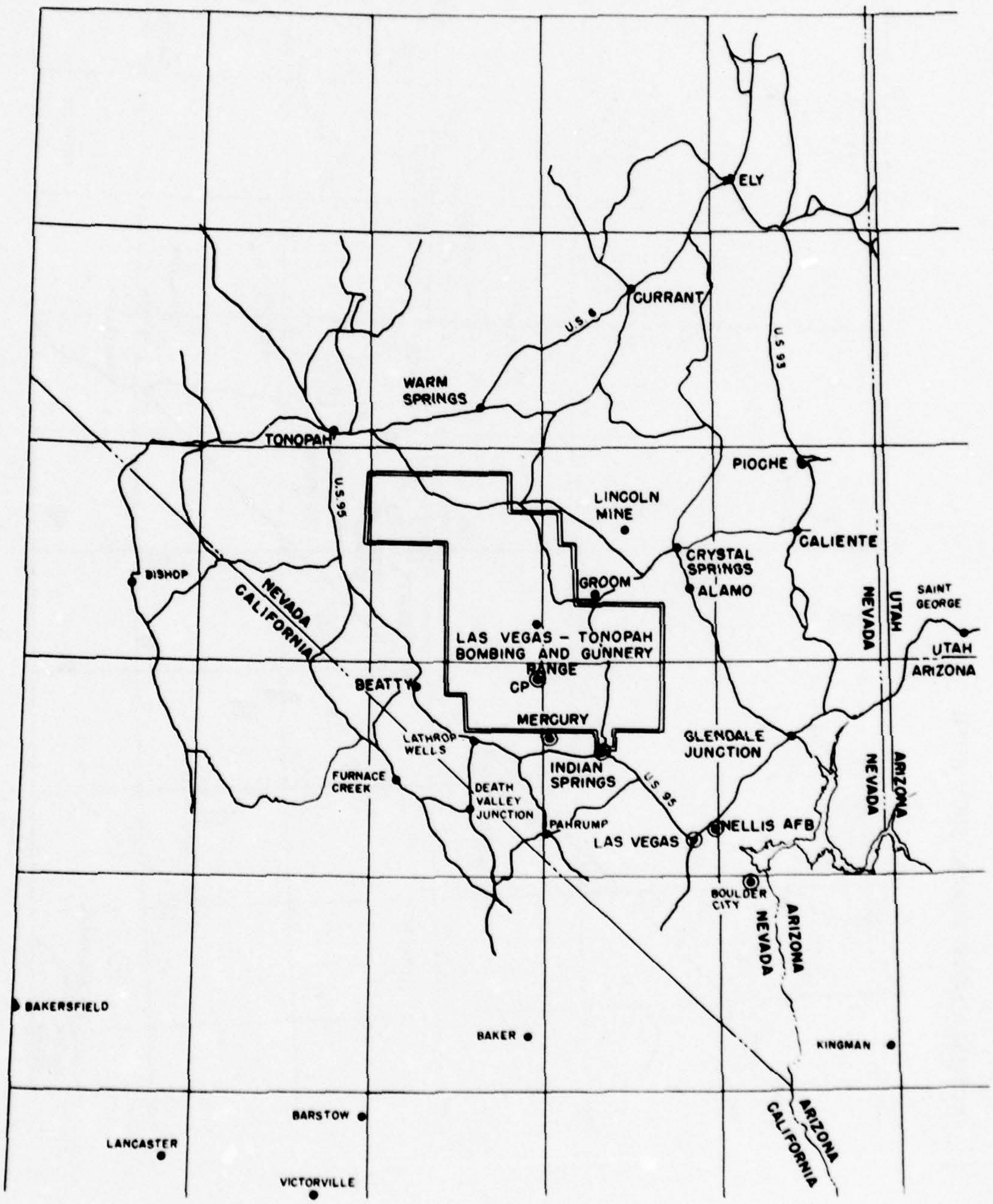
Based on data taken 2 April 1953, Yucca Flat.

[redacted]

UNCLASSIFIED

Inclosure 3

AIR SAMPLING STATIONS RECORDING FALL-OUT, SHOT RUTH

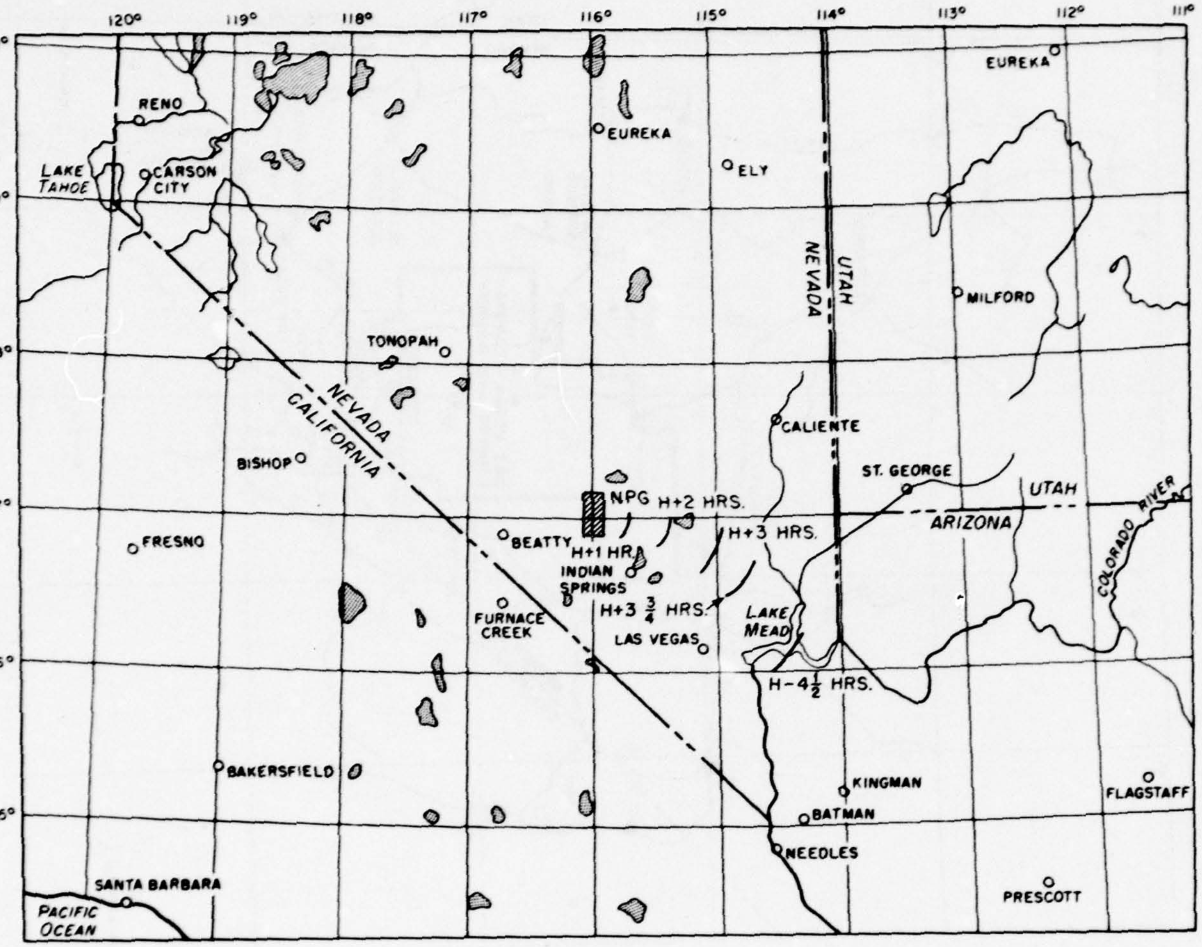


Shot Ruth, spring 1953. ◉ , air sampling stations recording fall-out.

[redacted]

Inclosure 4

ACTUAL CLOUD TRACK, SHOT RUTH

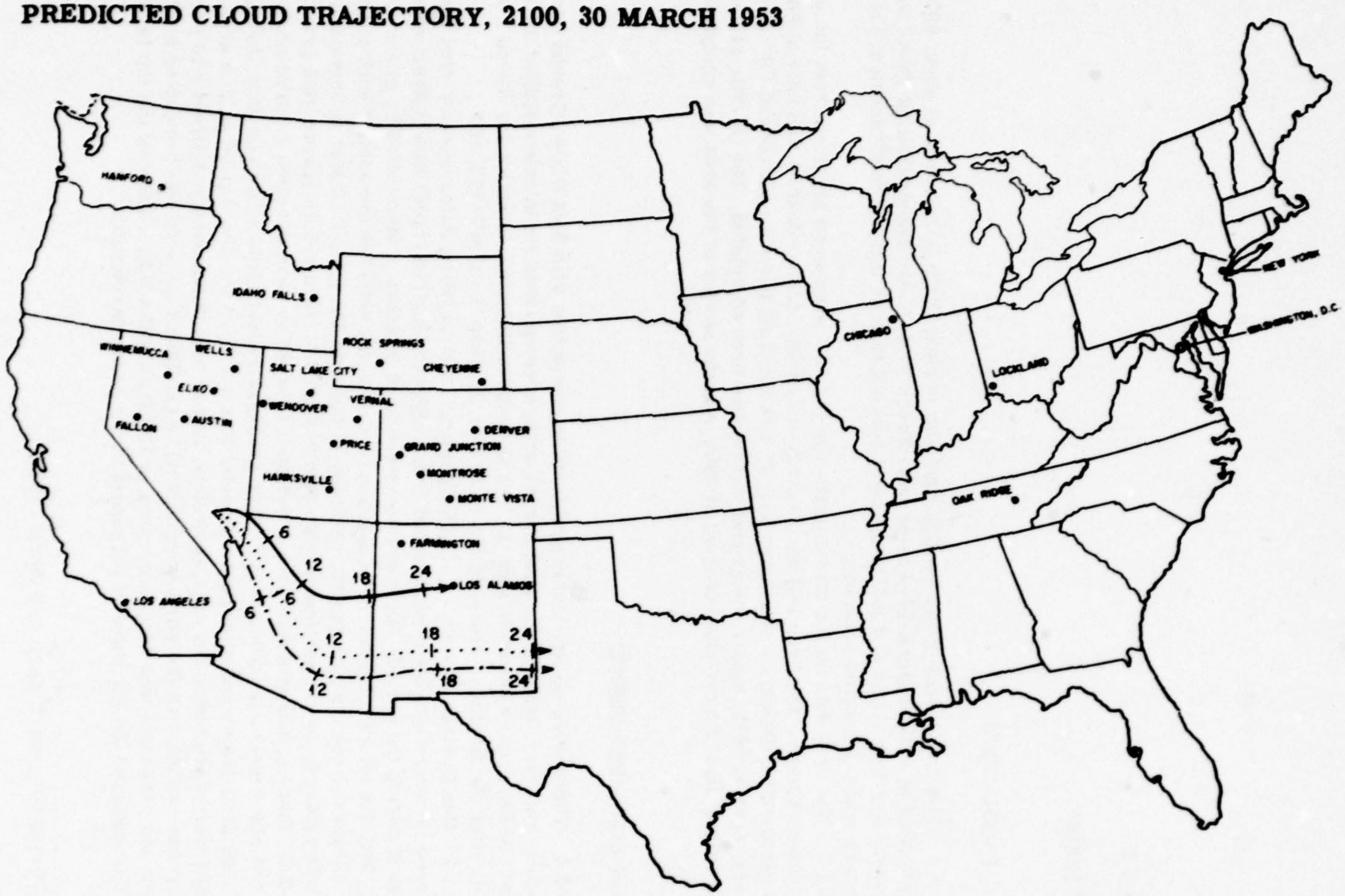


Shot Ruth, 31 March 1953. ———, cloud top (14,300 ft msl).

[redacted]

Inclosure 5

PREDICTED CLOUD TRAJECTORY, 2100, 30 MARCH 1953



Shot Ruth, 2100, 30 March 1953. ———, 10,000 ft msl. ·······, 20,000 ft msl, -·-·-·-·, 30,000 ft msl.

[redacted]

Chapter 5

SHOT DIXIE*

5.1 INTRODUCTION

5.1.1 The fourth shot of the Upshot-Knothole series, Dixie, an airdrop at about 6000 ft, was detonated at 0730, 6 April 1953 in Area 7, Yucca Flat, NPG. The prevailing winds were in the direction of Las Vegas and Indian Springs; but, because no fall-out was expected, the decision was made to drop on schedule.

5.1.2 The first data on the contamination in the shot area were received from the close-in helicopter survey. The area had been surveyed by 0810. Contamination was only slightly above background. Based on helicopter survey data the Test Director announced "R" (ground recovery) hour at 0812, before the ground survey had been completed. The On-Site ground survey teams' first report was received at 0805, and the survey of the area was completed at 0900.

5.2 ON-SITE OPERATIONS

5.2.1 There were no particular problems in connection with Shot Dixie. Ground contamination was very light. The initial survey team accomplished its mission without difficulty. A survey of the area is shown in Incl. 1. The general radiological situation for Yucca Flat on 7 April, after the first four shots, is shown in Incl. 2, Chap. 5, of WT-702(REF.).

5.2.2 One hundred seventy-nine (179) persons in sixty (60) parties were briefed and processed for entry into the contaminated areas. Eleven hundred (1100) film badges were processed during the period. Many of these were used in areas contaminated by previous shots. Only six (6) vehicles were decontaminated. Several vehicles were found with contaminated objects collected as souvenirs, contrary to the Test Director's Order; so these objects were taken away from the parties. A sign was designed to warn people against this practice.

5.2.3 Since construction in Area 2 had been delayed by contamination from previous shots and since much construction and other preparatory work was still to be done there, a film badge distribution and clothing issue point was set up at the check point to this area, and monitors were assigned to the area as needed, rather than being assigned directly to parties. To decrease exposure to the working personnel, a section of the area most occupied by the construction personnel was decontaminated by fencing it off and by removing the top layer of soil. This reduced the exposure of personnel in the area considerably.

---

* Period covered, 5 April to 9 April 1953.

[redacted]

5.3 OFF-SITE OPERATIONS

5.3.1 The changes in the anticipated fall-out pattern resulting from this detonation are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Sec. II, WT-705). By shot time, the area of primary interest was the sector around Glendale Junction, Overton, and Las Vegas. Off-Site mobile teams and equipment were moved to provide maximum coverage in the communities in the path of fall-out.

5.3.2 No ground levels were detected from this shot. A documentation of ground monitoring is given in Incl. 3, Chap. 5, of WT-702(REF.). Inclosure 4, Chap. 5, of WT-702(REF.) is a tabulation of air concentrations encountered from this detonation. It is evident from these results and those in Incl. 3, Chap. 5, of WT-702(REF.) that no detectable activity was collected by any of the equipment in use by the Off-Site Group, with one possible exception. This exception occurred at St. George, Utah, where a light shower for a brief period caused an increase in surface contamination as determined by radioautography and an MX-5 monitoring instrument. The results of water samples analyzed for fission product activity are presented in Incl. 5, Chap. 5, of WT-702(REF.).

5.4 AIR PARTICIPATION

5.4.1 Weather data indicated that the radioactive air mass would move in the direction of Indian Springs and Las Vegas. Little or no fall-out was expected; however, the radioactive air mass was considered to be hazardous to air traffic. To afford protection for this traffic, it was recommended that the air space at all altitudes for a radius of 50 miles from ground zero be closed to all except test aircraft from 0700 to 0830 PST on D-day. In addition, it was recommended that the air space enclosed by the vectors 90° and 180° from ground zero out to a distance of 100 miles be closed from 0830 to 0930 on D-day at 23,000 ft msl and below. Above 23,000 ft msl the air mass enclosed by a line connecting Las Vegas, Nevada, to Yuma, Arizona, to Nogales, Mexico, to Las Vegas was recommended closed from 0830 to 1330 PST. This was changed at 0945 PST to the area enclosed between 35° and 37° north latitude and between a line running north from Prescott and a line running north from Albuquerque. This change was necessary when it was determined that the cloud was going north of the predicted path. In addition to all of the above, a warning area was recommended to extend for a radius of 125 miles in all directions from Las Vegas at all altitudes from 0700 to 1330 PST.

5.4.2 The cloud left no visible stem. However, the cloud tracking aircraft, two B-29's and a B-25, were off from Indian Springs AFB on schedule. They were not able to find any activity at their respective altitudes of 22,000 ft, 18,000 ft, and 12,000 ft msl. They were then released and returned to base. The position of the mushroom was followed by sampler aircraft who followed the cloud for more than $4\frac{1}{2}$ hr. The cloud trajectory is shown in Incl. 2; the predicted path is presented as Incl. 3. The top of the cloud went to 42,500 ft msl, whereas the bottom of the mushroom was at 31,500 ft msl. No activity was detected outside the mushroom. By H + $4\frac{1}{2}$ hr the cloud had traveled more than 350 miles. The data from the cloud tracking aircraft are shown in Incl. 6, Chap. 5, of WT-702(REF.).

5.4.3 The close-in aerial survey was made by helicopter. It started at H+ 15 min and by H+ 40 min had completed the survey of the target area. The maximum reading in the target area was 1.5 mr/hr at 5 ft above the ground. The data are presented as Incl. 8, Chap. 5, of WT-702(REF.).

5.4.4 The extended terrain survey was performed by an L-20 and a C-47 aircraft. No contamination was found during the survey. The L-20 data and the C-47 data are presented as Incls. 9 and 10, Chap. 5, of WT-702(REF.). No D + 1 day survey was made.

5.5 LOGISTICS AND SUPPLY

5.5.1 For the period 5 to 9 April 1953, inclusive, the Supply Section issued 132 pairs of shoe covers, 73 protective caps, 83 coveralls, 113 pairs of cotton gloves, 268 high intensity goggles, and 51 respirators. The laundry serviced 444 pairs of shoe covers, 12 protective caps, 181 coveralls, 578 pairs of gloves, 92 respirators, 36 pillowcases, 72 sheets, and 35 towels. During the period, 41 instruments were issued and 52 repaired by the instrument repair section. Nineteen (19) vehicles were lubricated and given 2nd echelon maintenance; four (4) vehicles were deadlined during the period.

5.5.2 To improve communication for On-Site vehicles, isoplane antennas were installed on the five (5) ¾ ton trucks. This has somewhat improved radio transmission.

5.6 GENERAL

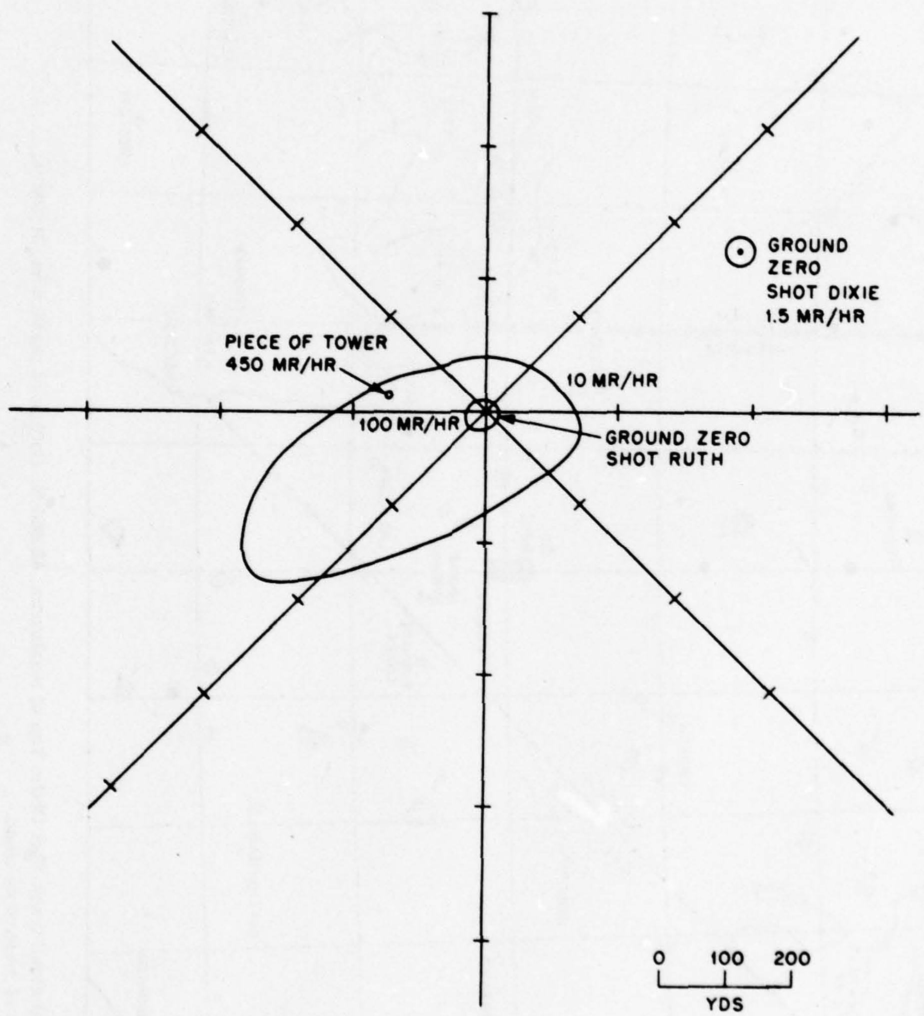
The radiological problem connected with Shot Dixie was almost nonexistent. No ground contamination was found anywhere, even at ground zero. There was no cloud stem to be found. All the activity was in the mushroom which went to an altitude of 42,500 ft. The winds were so great at this altitude that it was past the 200 mile zone by H + 3 hr.

[redacted]

UNCLASSIFIED

Inclosure 1

INITIAL SURVEY, SHOT DIXIE, 0800, 6 APRIL 1953

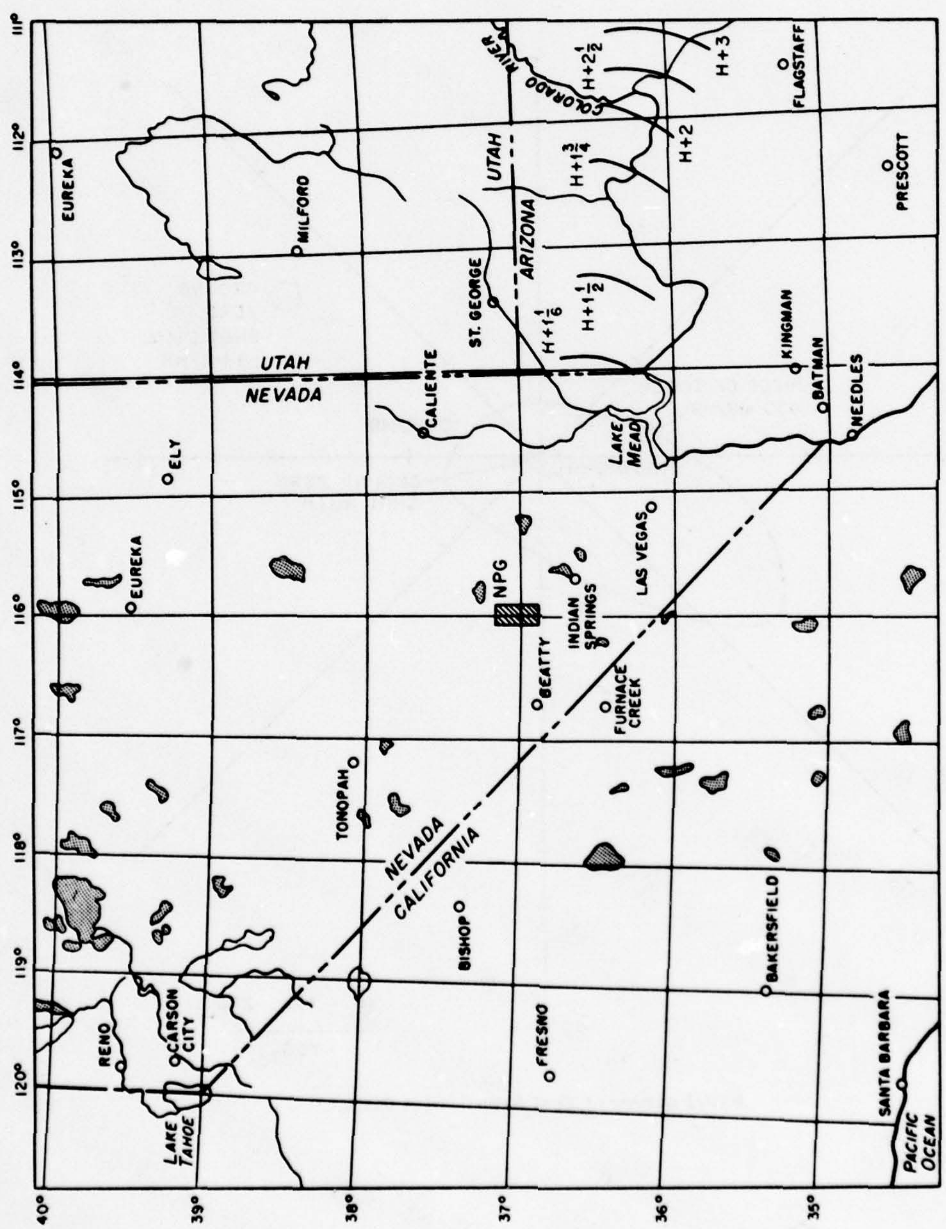


Initial survey of Test Area 7, Shot Dixie.

UNCLASSIFIED

Inclosure 2

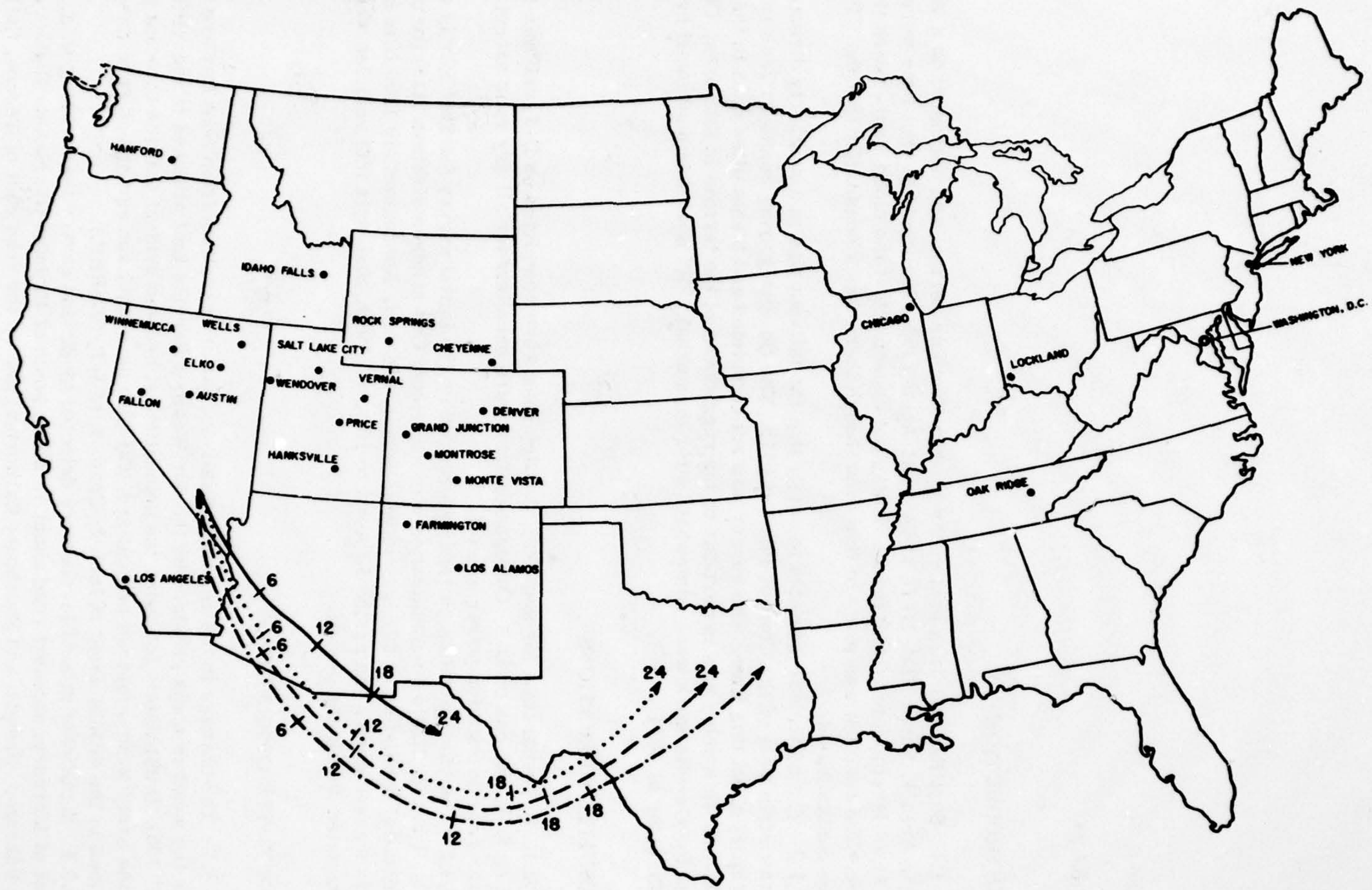
ACTUAL CLOUD TRACK, SHOT DIXIE



Actual cloud track, Shot Dixie. Top of mushroom, 42,000 ft. Bottom of mushroom, 31,500 ft. ———, track of mushroom cloud.

Inclosure 3

PREDICTED AIR TRAJECTORY, 2100, 5 APRIL 1953



——, 10,000 ft msl. ...., 20,000 ft msl. -.-.-.-, 30,000 ft msl. -------, 40,000 ft msl.

[redacted]

Chapter 6

SHOT RAY*

6.1 INTRODUCTION

6.1.1 Shot Ray, the fifth shot of the Upshot-Knothole series, was detonated on a 100 ft tower in Area 4, Yucca Flat, NPG, at 0445, 11 April 1953. The winds at shot time were to the south at all levels up to 20,000 ft msl. It was not expected that the cloud would reach this altitude. The decision was made to fire even though there was a possibility that the CP might become contaminated.

6.1.2 The helicopter was able to verify that the fall-out was in a southerly direction in a narrow strip west of the Control Point at 0515. The On-Site ground monitors radioed their first report about this time. The survey was not completed and transmitted back to the CP until 0630 hr. This delay was in part due to the ruggedness of the terrain in this area. Communications for On-Site work were somewhat better than usual. "R" hour was announced by the Test Director at 0624.

6.2 ON-SITE OPERATIONS

6.2.1 In preparation for Shot Ray, two dry runs were completed on D-3, one was completed on D-2, and one on D-1. Communications were excellent for all dry runs except on D-2 when the repeater station power was off.

6.2.2 The contamination pattern determined by the initial survey for Shot Ray is shown in Incls. 1 and 2. Radio communication was excellent. One hundred eighteen (118) parties and work details, consisting of 521 individuals, were processed. Approximately 1100 film badges were processed during the period 10 April to 16 April 1953. Sixty-six (66) vehicles were decontaminated during the period.

6.3 OFF-SITE OPERATIONS

6.3.1 The changes in the anticipated fall-out pattern resulting from Shot Ray are delineated in the weather maps provided by the Air Weather Service Unit attached to the NPG (Sec. II, WT-705). Immediately following the detonation, it became evident that the forecast pattern from the early wind would not be realized. Off-Site personnel and equipment were moved as described in the events listed in Incl. 3, Chap. 6, of WT-702(REF.).

6.3.2 Significant ground levels were detected by ground survey teams along U. S. Highway 95 west of Mercury; a desert road about 15 miles south of Highway 95; Nevada Highway 52 between Pahrump, Nevada, and Shoshone, California; and on the road east of Tecopa, California.

*Period covered, 10 to 16 April 1953.

UNCLASSIFIED

Shoshone, Tecopa, Tecopa Hot Springs, California, and Pahrump, Nevada, were the only communities in which fall-out of a detectable nature occurred. Results of the ground survey teams are given in Incl. 4, Chap. 6, of WT-702(REF.). At points other than the above, contamination detected was residual from previous detonations.

6.3.3 Air sampling results confirm the pattern of fall-out shown by the ground survey teams. Samples collected at CP, Mercury, Indian Springs, Las Vegas, Nellis AFB, and Death Valley Junction indicate further that minor quantities of activity from Shot Ray were present at these locations. A tabulation of air concentrations from this shot is given in Incl. 5, Chap. 6, of WT-702(REF.). The results of water samples analyzed for fission product activity are presented in Incl. 6, Chap. 6, of WT-702(REF.).

6.3.4 A pictorial presentation of the Off-Site fall-out pattern is shown in Incl. 3.

6.4 AIR PARTICIPATION

6.4.1 The cloud was anticipated to reach only 15,000 ft msl. This precluded closing of the air space above 20,000 ft msl. The air space below 20,000 ft msl was closed for a radius of 50 miles between the 90° vector left to the 180° vector from 0430 to 0700 on D-day. In addition, the air space below 20,000 ft msl and between the 90° and 180° vectors (changed to 90° to 200° vectors at 0510) out to the west side of Amber 2 was closed from 0430 to 0700. The warning circle extended for a radius of 125 miles in all directions from Las Vegas, Nevada.

6.4.2 The cloud reached an altitude of 14,000 ft msl. This low altitude, plus the fact that it immediately passed over terrain 7,500 ft msl, left less than seven thousand (7,000) ft of cloud to track. Consequently, cloud tracking aircraft were not used. The position of the cloud was determined by the cloud sampling aircraft. Their data are given in Incl. 8, Chap. 6, of WT-702(REF.). The actual cloud track and the predicted cloud path are plotted in Incls. 4 and 5.

6.4.3 The helicopter again made a close-in aerial survey. It was off at H+15 min and by H+30 min had delineated the general area of the close-in fall-out. The last part of the mission was spent tracing the south position of the ground contamination. From the data submitted, as given in Incl. 10, Chap. 6, of WT-702(REF.), the limits of contamination could be determined. This agreed with the ground monitor data taken some time later.

6.4.4 The L-20 and C-47 were off on the extended terrain survey at H+2 hr and H+2 hr and 15 min, respectively. Inclosures 11 and 12, Chap. 6, of WT-702(REF.) contain these data. The fall-out pattern was so narrow that no plot was made since it would appear almost as a line. No survey was necessary on D+1.

6.5 LOGISTICS AND SUPPLY

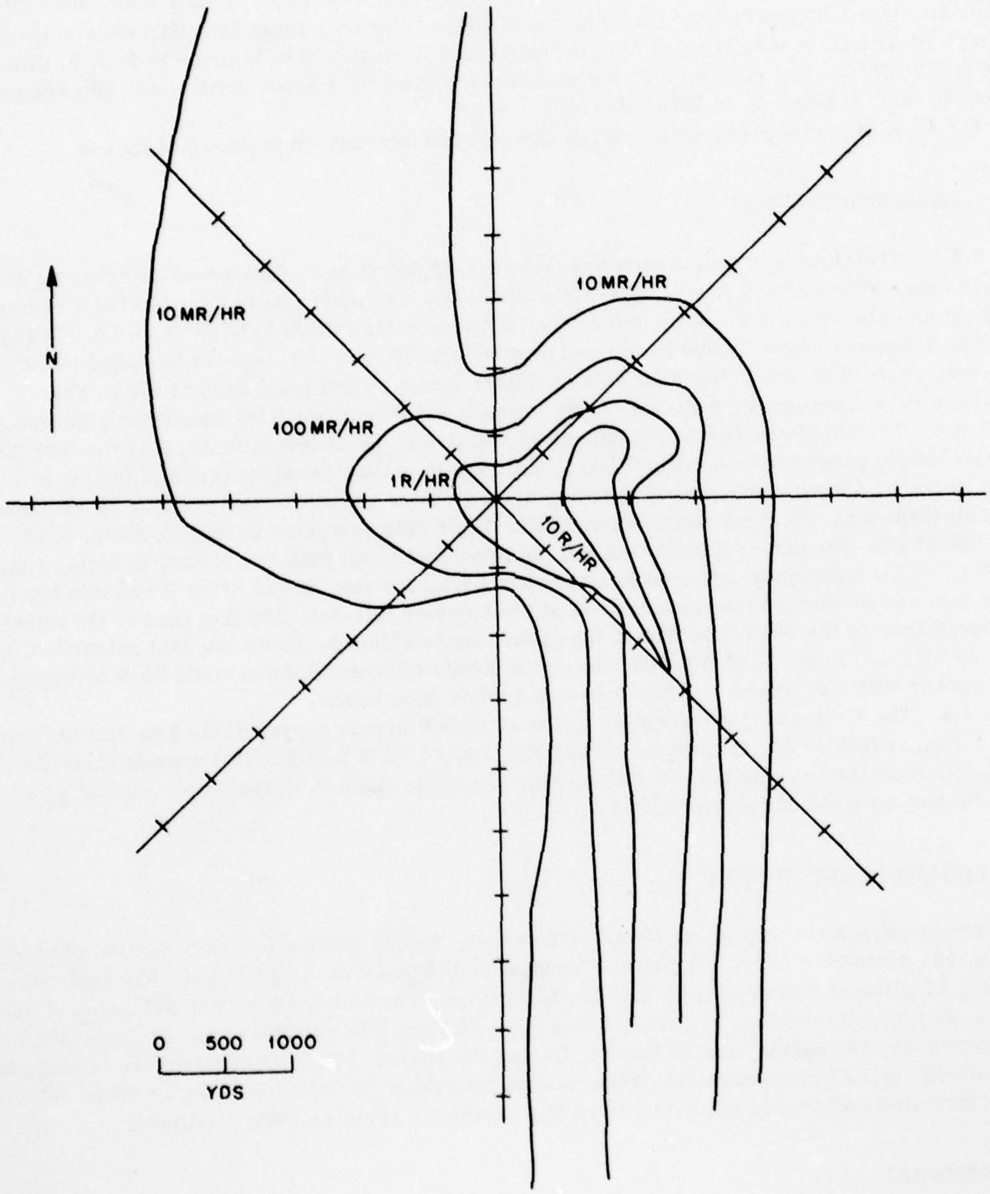
For the period 10 to 16 April 1953, inclusive, the Supply Section issued 516 pairs of shoe covers, 181 protective caps, 215 pairs of coveralls, 154 pairs of cotton gloves, 289 high intensity goggles, 12 pairs of rubber gloves, and 53 respirators. The laundry serviced 511 pairs of shoe covers, 95 protective caps, 351 pairs of coveralls, 322 pairs of cotton gloves, 42 respirators, 90 pillowcases, 180 sheets, and 88 towels. During the period, 143 instruments were issued and 79 repaired. Second echelon maintenance was performed on 23 vehicles. Twenty-three vehicles were lubricated and weekly maintenance pulled. Seven (7) vehicles were deadlined.

6.6 GENERAL

The radiological problem for this shot was much greater than for Shot Ruth. The use of a 100 ft tower instead of a 300 ft tower was the main factor in this increase of contamination. The fall-out pattern was very narrow. It proceeded just west of the Control Point and extended approximately 45 miles to the south. No populated area was in the fall-out path. This minimized the Rad-Safe problem.

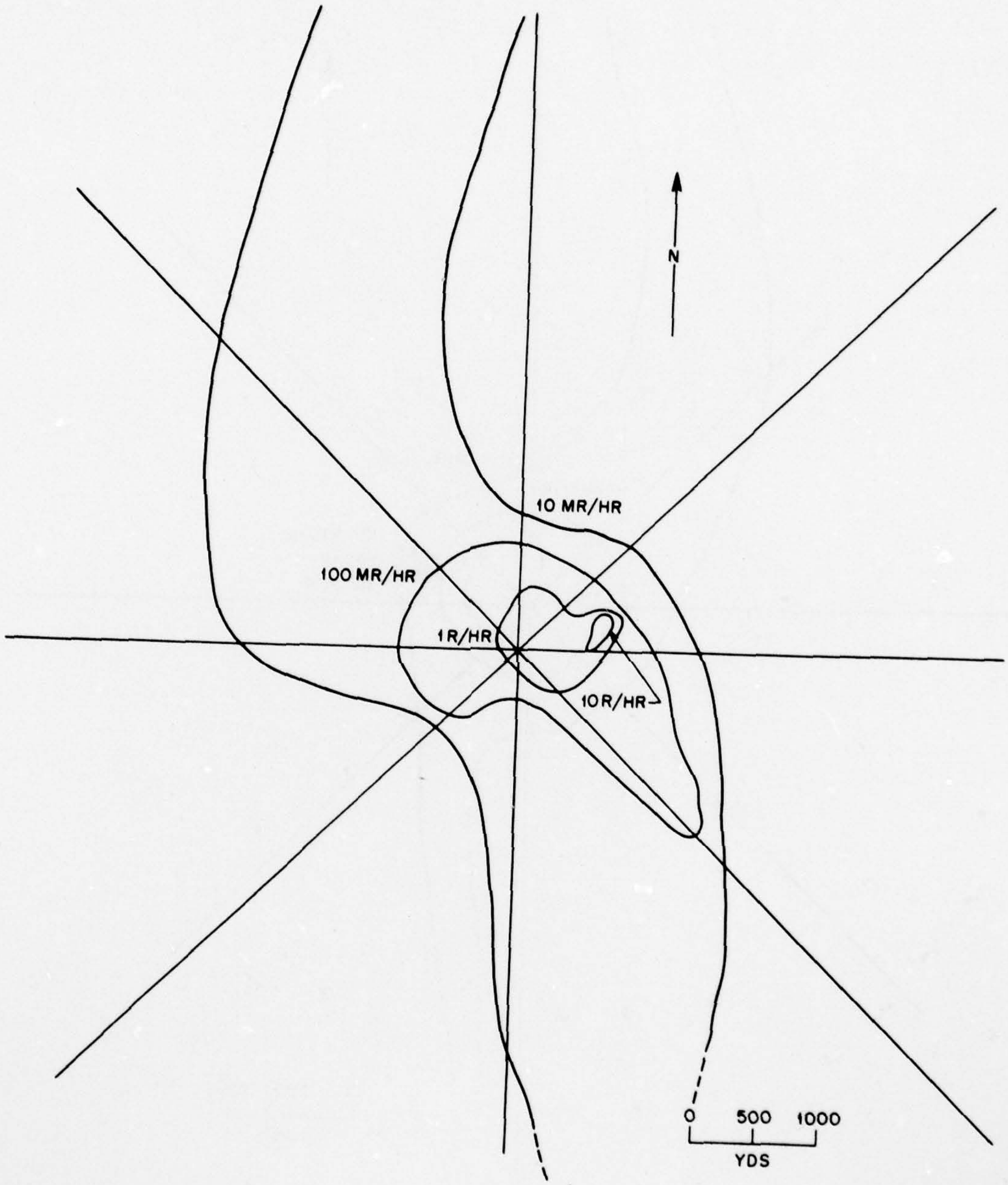
Inclosure 1

SURVEYS OF TEST AREA 4



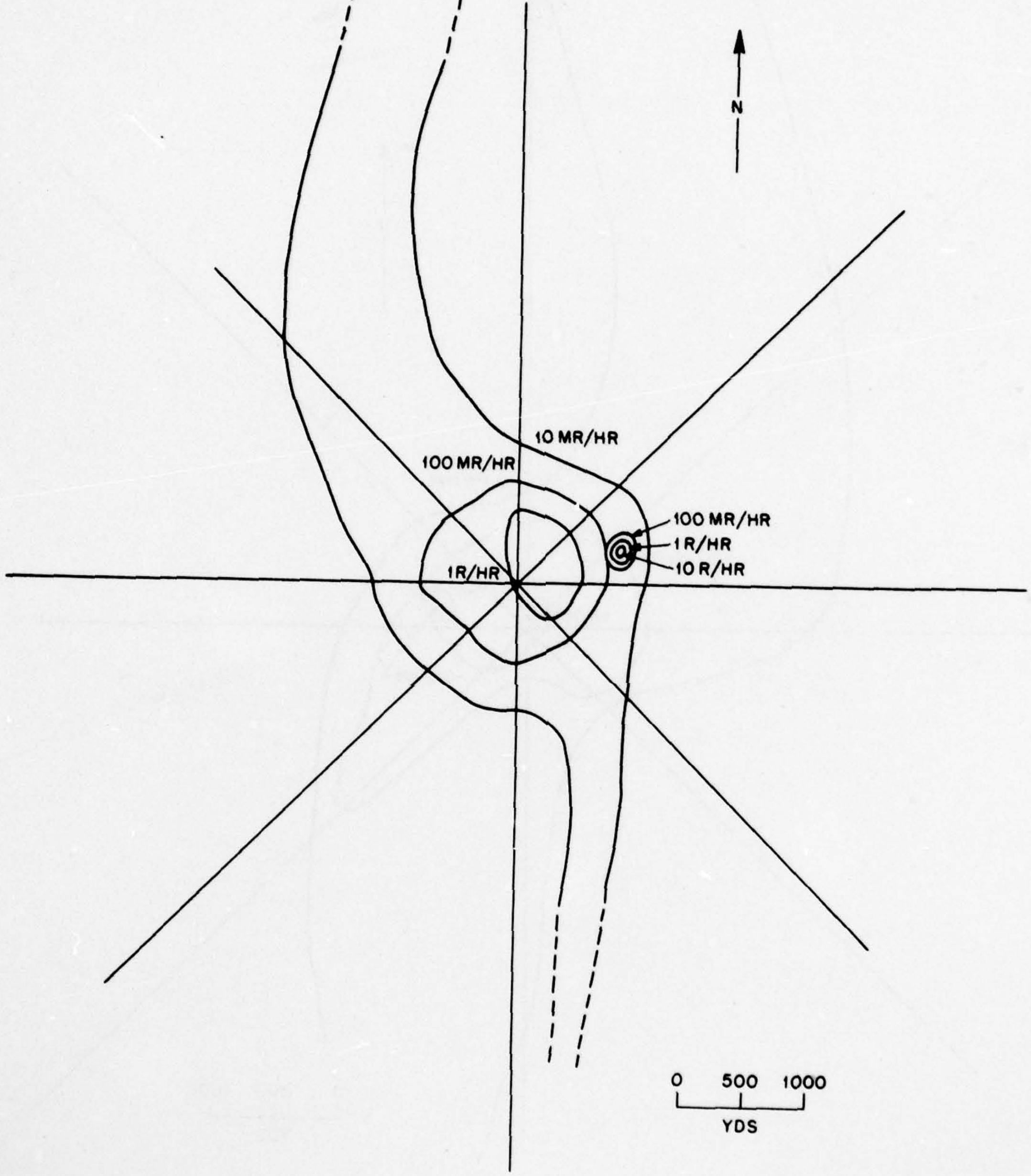
Initial survey, 0630. H-hour, 0445, 11 April 1953.

[redacted]



Resurvey, 0700, 12 April 1953.

[redacted]

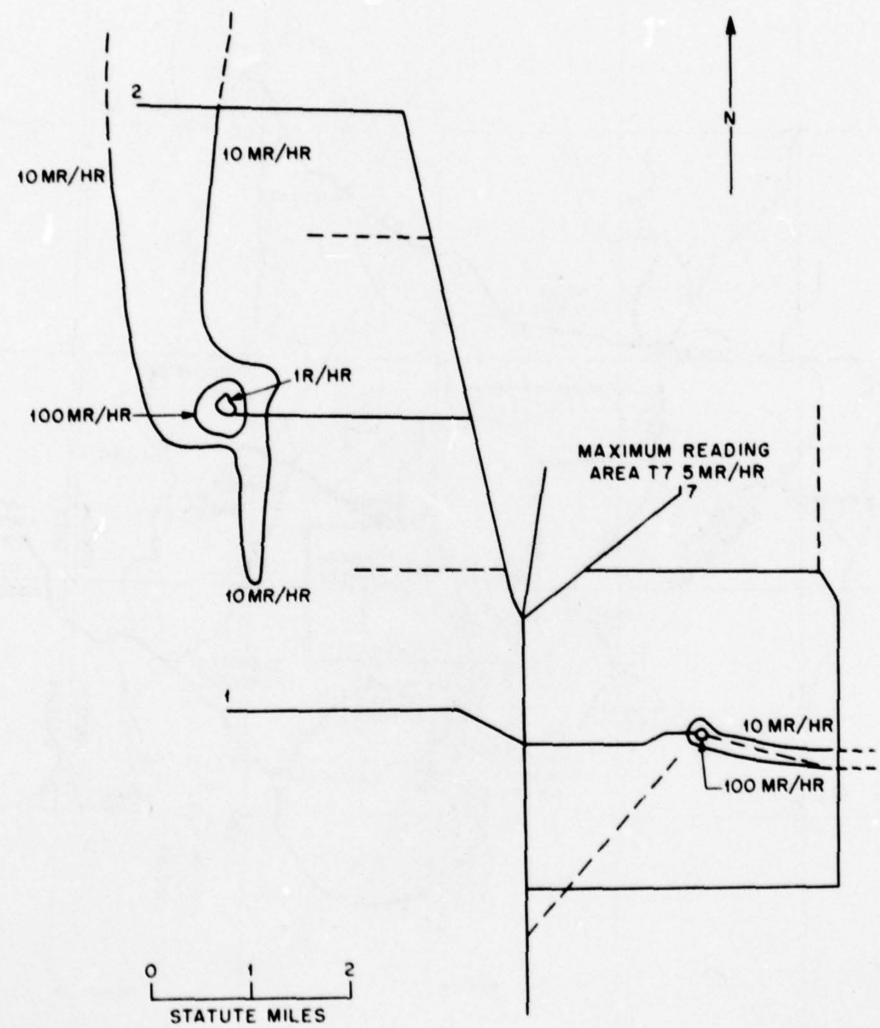


Resurvey, 0700, 13 April 1953.

[redacted]

Inclosure 2

YUCCA FLAT RADIOLOGICAL SITUATION, 0700, 14 APRIL 1953



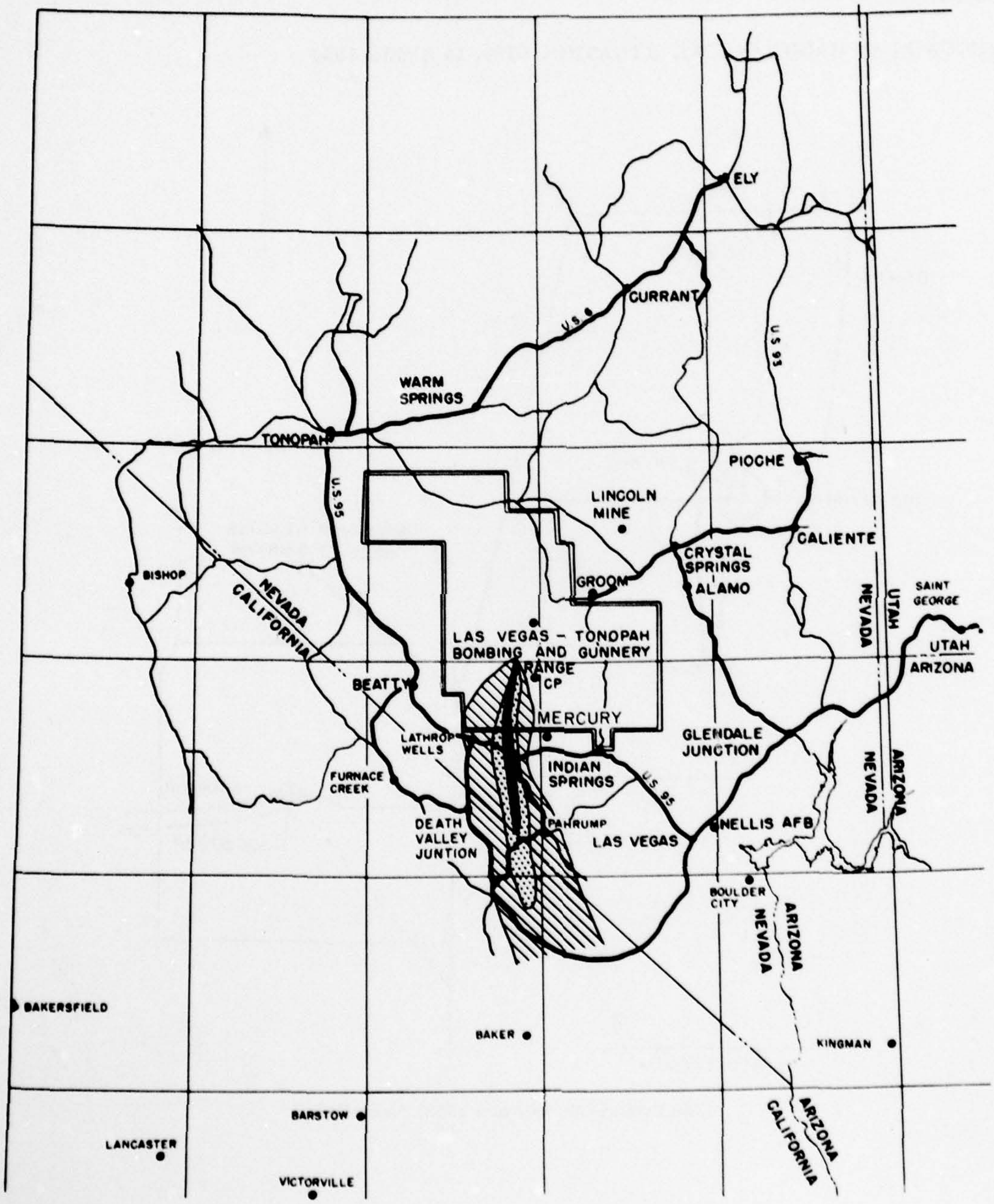
Data taken 0700, 14 April 1953, Yucca Flat.

[redacted]

UNCLASSIFIED

Inclosure 3

RADIATION INTENSITY AT TIME OF FALL-OUT, SHOT RAY

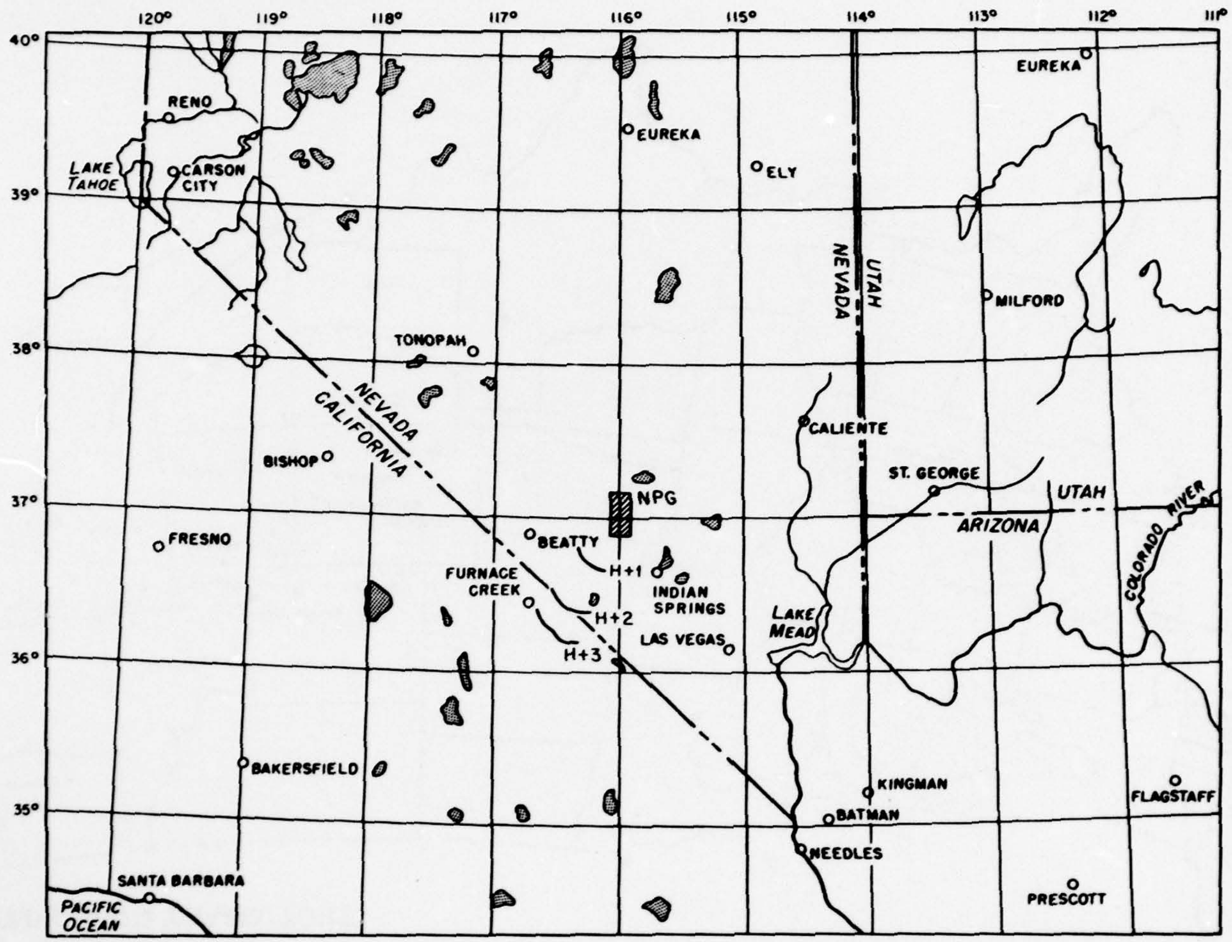


■, 20 to 200 mr/hr. ░, 2 to 20 mr/hr. ▨, 0.2 to 2 mr/hr. Heavy lines indicate the monitor runs.

UNCLASSIFIED

Inclosure 4

CLOUD TRACKING DATA, SHOT RAY

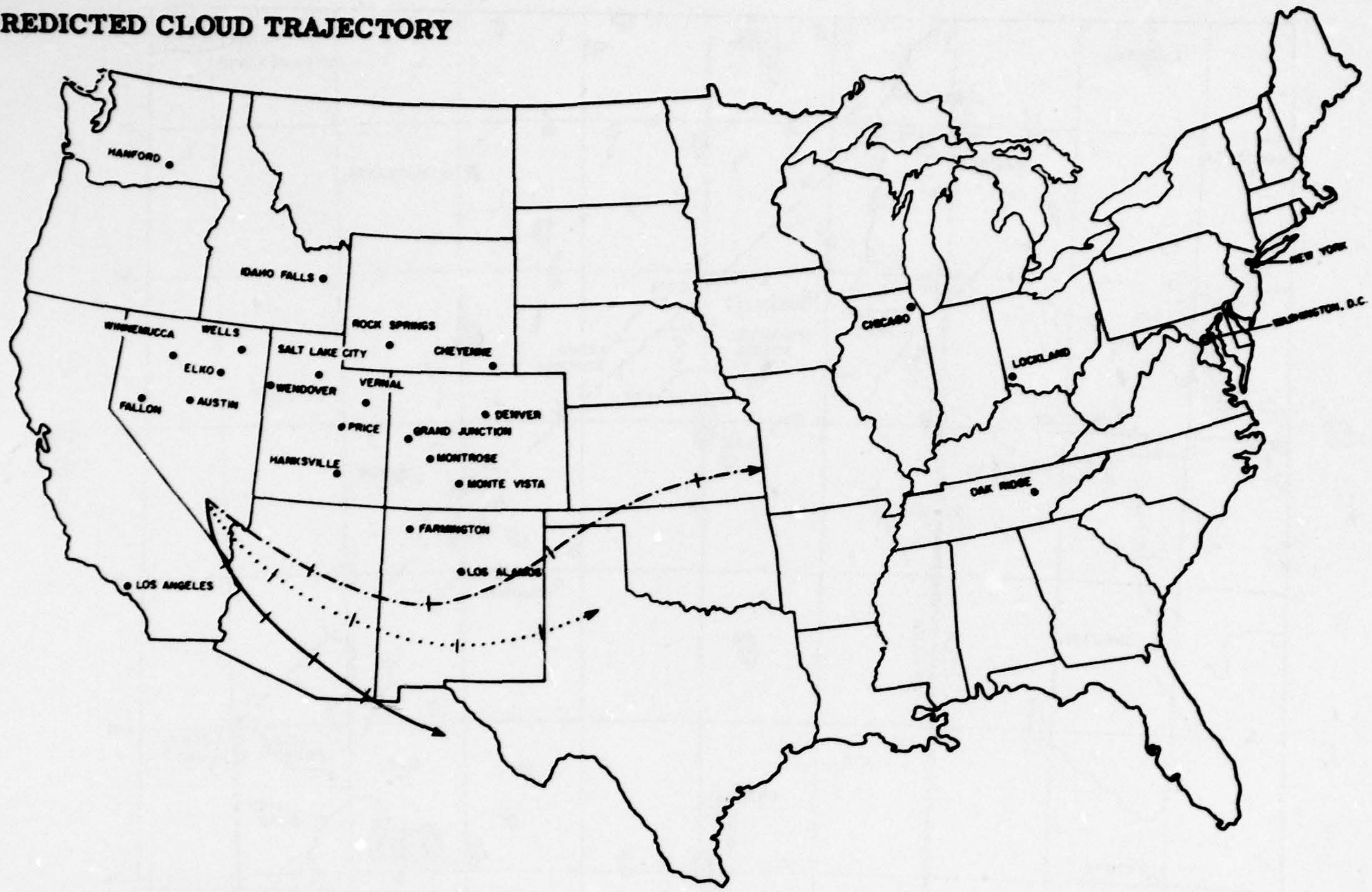


Cloud track, 11 April 1953. ———, top of cloud 14,000 ft msl.

[redacted]

Inclosure 5

PREDICTED CLOUD TRAJECTORY



Predicted trajectory, 2100, 11 April 1953. ———, 8,000 ft msl. ...., 10,000 ft msl. —·—·—·—, 15,000 ft msl.

[redacted]

UNCLASSIFIED

Chapter 7

SHOT BADGER*

7.1 INTRODUCTION

7.1.1 The sixth shot of the Upshot-Knothole series, Badger, was detonated on a 300 ft tower in Area 2 of Yucca Flat, NPG, at 0435 PST, 18 April 1953. The winds were from the west and forecast to remain in that general direction when the decision to fire was made at the 2100 PST weather briefing on 17 April 1953.

7.1.2 Initial radiation survey reports were received from On-Site at 0450. The survey was completed at 0730. The long time required for this survey was caused by the rough terrain over which some of the monitor teams had to travel. Normal access routes to the north and northeast of the area were blocked by radiation fields higher than 50 r/hr.

7.1.3 Mercury Highway south of the CP was cleared at 0505. Frenchman Flat was declared open at 0520. Five projects were released at 0630, and two projects were released at 0639. R hour was not declared until 0710.

7.2 ON-SITE OPERATIONS

7.2.1 Six stake lines were laid along the roads in the T-2 area for this shot. As contamination fell southeast across Mercury Highway, it was necessary for the survey teams to enter the shot area from the west without use of the highway or the main access road to the area. The teams started their survey at 0450 and did not complete it until 0730. Survey plots are given in Incl. 1.

7.2.2 Generally, recovery parties were not allowed to cross the 10 r/hr line; however, on this shot parties in vehicles were allowed to use Mercury Highway to reach the recovery area which was contaminated by fall-out of intensity greater than 50 r/hr. This led some parties to the belief that they could recover test data in areas greater than 10 r/hr without specific permission from the Test Director's Staff and resulted in some overexposures.

7.2.3 One hundred thirty-three (133) recovery parties, consisting of 396 personnel, were processed into the contaminated areas during this period. Approximately 1,600 film badges were processed. Ninety-two (92) vehicles were decontaminated.

7.2.4 Owing to the overexposures on this shot, a special training program for monitors was initiated by the On-Site Operations Officer.

7.2.5 A group of 16 FCDA personnel were conducted on a guided tour of the Rad-Safe Building on 23 April. Discussions were held with each section, and considerable time was spent instructing these personnel in the calibration of survey instruments.

---

*Period covered, 17 to 23 April, 1953.

7.3 OFF-SITE OPERATIONS

7.3.1 The changes in the anticipated fall-out pattern resulting from Shot Badger are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705). The actual pattern was not clear until after the detonation. This resulted in the movement of mobile personnel and equipment.

7.3.2 Significant ground levels were detected in the sector from south of Glendale Junction, Nevada, to Mercury, Nevada, and as far east as Arizona Highway 64 between Williams, Arizona, and the South Rim of the Grand Canyon of the Colorado River. A documentation of ground monitoring results is given in Incl. 2, Chap. 7, of WT-702(REF.). Maximum fall-out occurred in the region between U. S. Highway 91, Lake Mead, and east. The report of a special survey of this area for inhabitants, domestic animals, and other pertinent data has been compiled in Incl. 3, Chap. 7, of WT-702(REF.). Infinite doses for localities of interest are given in Incl. 2. It was noted that monitoring data indicated a duration of fall-out considerably longer than previously experienced.

7.3.3 Air sampling results confirm the pattern of paragraph 7.3.2. Samples collected at Glendale Junction and Overton, Nevada, showed further that minor quantities of activity from Shot Badger were found at these locations. The extended period of fall-out was also observed in the air samples. A tabulation of air concentrations from this shot is given in Incl. 5, Chap. 7, of WT-702(REF.).

7.3.4 The results of water samples analyzed for fission product activity are presented in Incl. 7, Chap. 7, of WT-702(REF.).

7.3.5 The pictorial presentation of the ground monitoring pattern is shown in Incl. 3.

7.4 AIR PARTICIPATION

7.4.1 The cloud was forecast to go to the East South East. This affected the closing of the air space enclosed by the 45° and 120° vectors from ground zero to Amber 2 Airway at all altitudes from 0400 to 0530 PST. In addition, the air space enclosed by the 45° vector left to the 120° vector for a 50 mile radius was closed at all altitudes from 0400 to 0530 PST. At 21,000 ft msl and above, the area enclosed by a line from Las Vegas to Albuquerque to Grand Junction to Milford to Las Vegas was closed from 0500 to 1100 PST. The altitude was increased from 21,000 to 27,000 ft at 0523. The enclosed area was changed to Las Vegas to El Paso to Albuquerque to Durango to Las Vegas at 0610. So much activity was still in the cloud at 1100 PST that the area bounded by Durango to Albuquerque to El Paso to Fort Worth to Durango was closed above 27,000 ft msl from 1100 to 1700 PST. The warning circle was a 200 mile radius from Las Vegas in all directions from 0400 to 0530 PST.

7.4.2 The maximum cloud height was 37,200 ft msl as determined by cloud sampling aircraft. The three cloud tracking aircraft, two B-29's and one B-25, determined the position of the stem at 22,000, 18,000, and 12,000 ft msl, while the position of the top was determined by sampling aircraft. The data are listed in Incl. 8, Chap. 7, of WT-702(REF.). These data are plotted in Incl. 4. The predicted path is shown in Incl. 5.

7.4.3 The helicopter made the close-in terrain survey. The data collected, as given in Incl. 11, Chap. 7, of WT-702(REF.), were satisfactory. The pilot and monitor were overexposed, however, due to poor decisions on the part of the monitor.

7.4.4 The L-20 and C-47 performed the extended terrain survey as usual. Communications were never established with the L-20; consequently a late change made in the pattern was not effected. Its original pattern and the data collected by this aircraft are shown in Incl. 12, Chap. 7, of WT-702(REF.). The changed pattern for the C-47 was received. This pattern and the data collected are shown in Incl. 13, Chap. 7, of WT-702(REF.). On D+1 a resurvey was made by the C-47. The data for this flight are shown in Incl. 14, Chap. 7, of WT-702(REF.). The final plot of the fall-out area using all the data collected above along with data from Off-

[redacted]

Site ground monitors shows a fall-out area that was narrow but extended more than 135 miles (Incl. 6). The second maximum west of Lake Mead had a time of fall of $3\frac{1}{2}$ to 4 hours' duration. This was at least one hour longer than was expected.

7.5 LOGISTICS AND SUPPLY

For the period, the Supply Section issued 238 protective caps, 274 pairs of shoe covers, 261 pairs of coveralls, 117 respirators, 133 pairs of cotton gloves, and 527 high intensity goggles. The laundry serviced 108 protective caps, 402 pairs of shoe covers, 369 pairs of coveralls, 145 respirators, 161 pairs of cotton gloves, 72 towels, 56 sheets, and 28 pillowcases. The laundry also serviced 3 bags of contaminated clothing for Indian Springs. Sixty-three (63) instruments were issued and 54 repaired. Twelve (12) vehicles received second echelon maintenance. Five (5) vehicles were deadlined during the period.

7.6 GENERAL

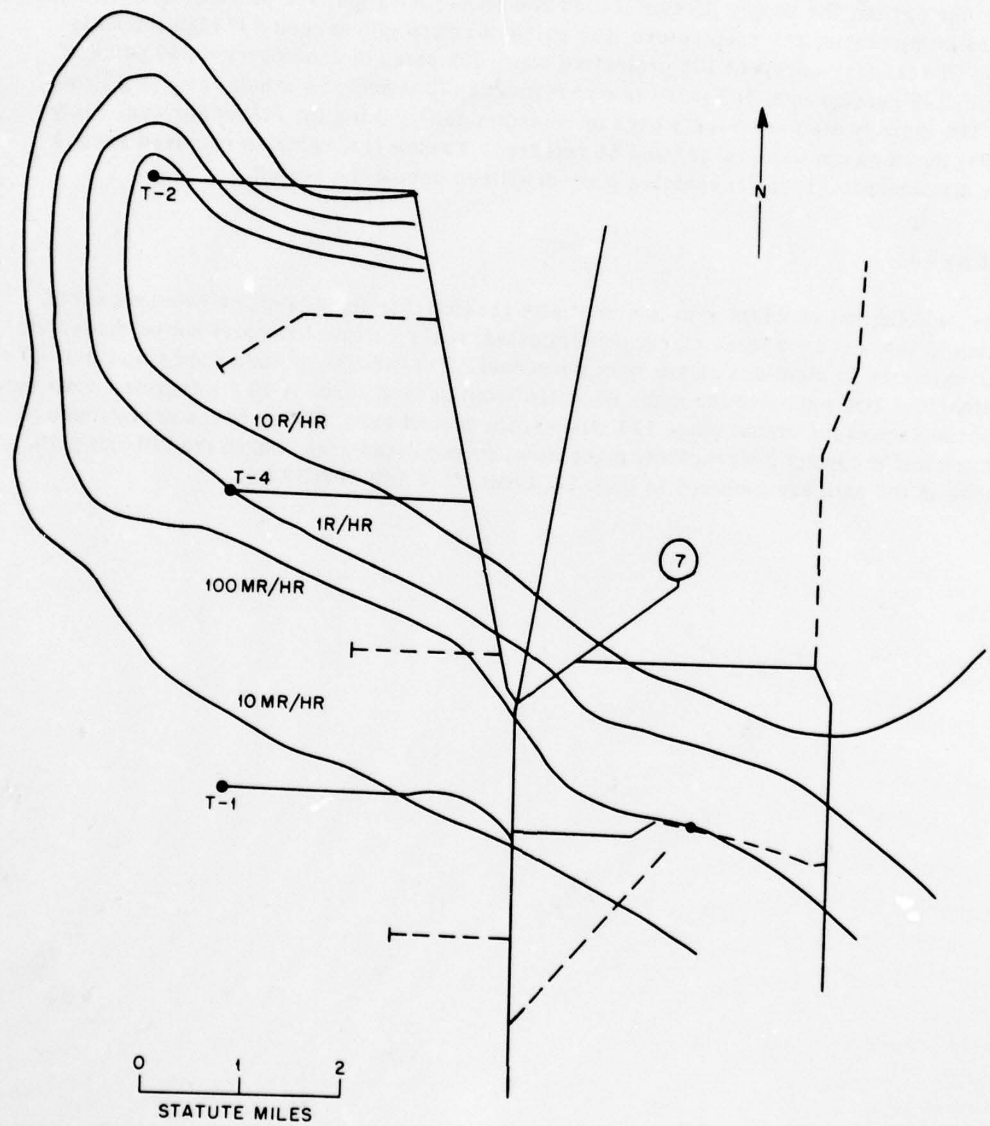
The radiological problem with this shot was greater than for any of the previous shots. As routes to the test area were highly contaminated, early recoveries could not be made without high exposure to monitors and project personnel. The Off-Site picture shows that the 100 r integrated dose line extended for some 35 miles from ground zero. A 10 r integrated dose was found in the second maximum some 110 miles from ground zero. Owing to the narrowness of the pattern and the exact geographical placement, no populated area was in the fall-out path. Any cattle in the path are included in Incl. 14, Chap. 7, of WT-702(REF.).

[redacted]

UNCLASSIFIED

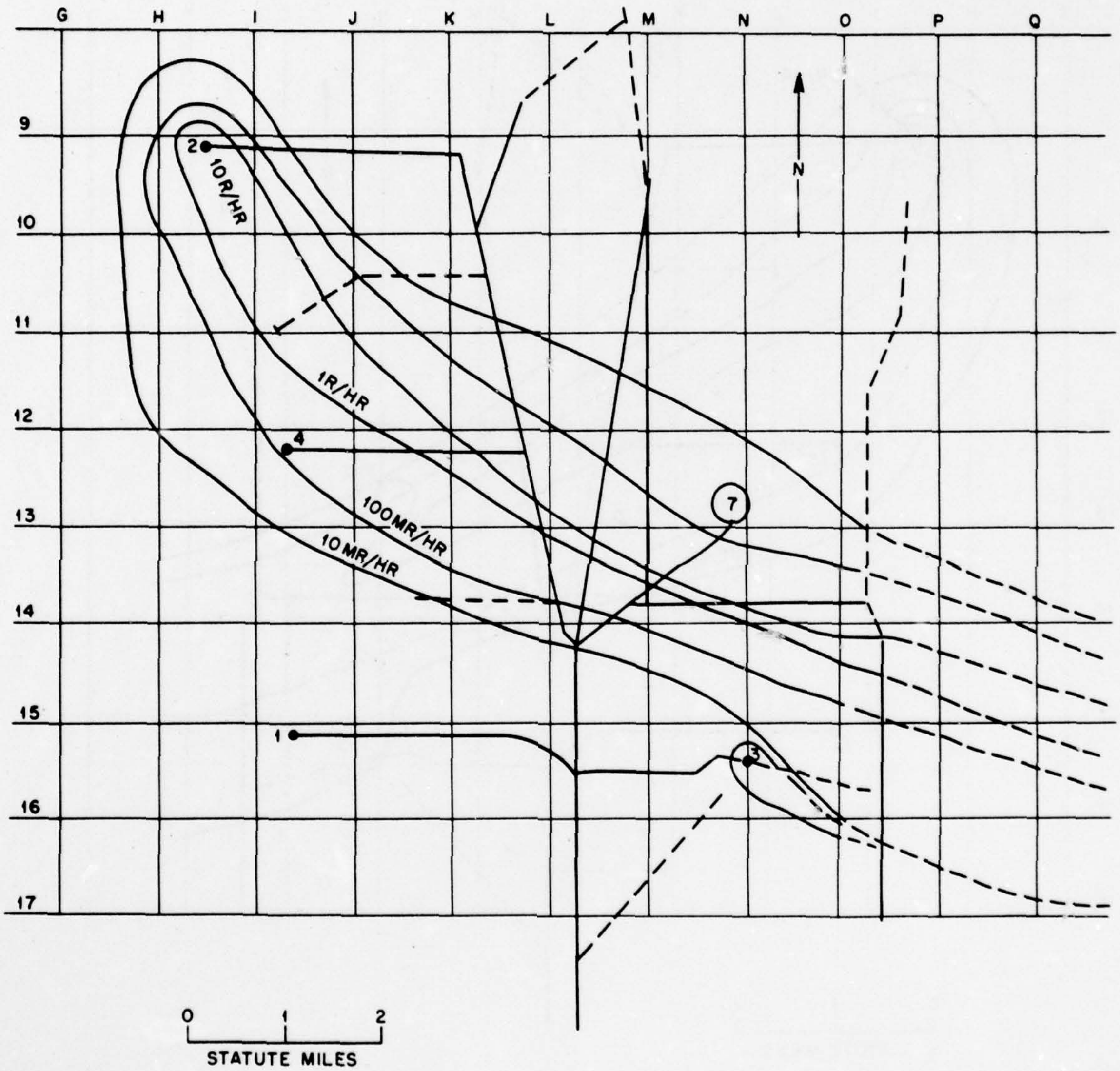
Inclosure 1

SHOT BADGER SURVEYS



Initial survey, 0800, 18 April 1953. Area T-2, H-hour, 0435.

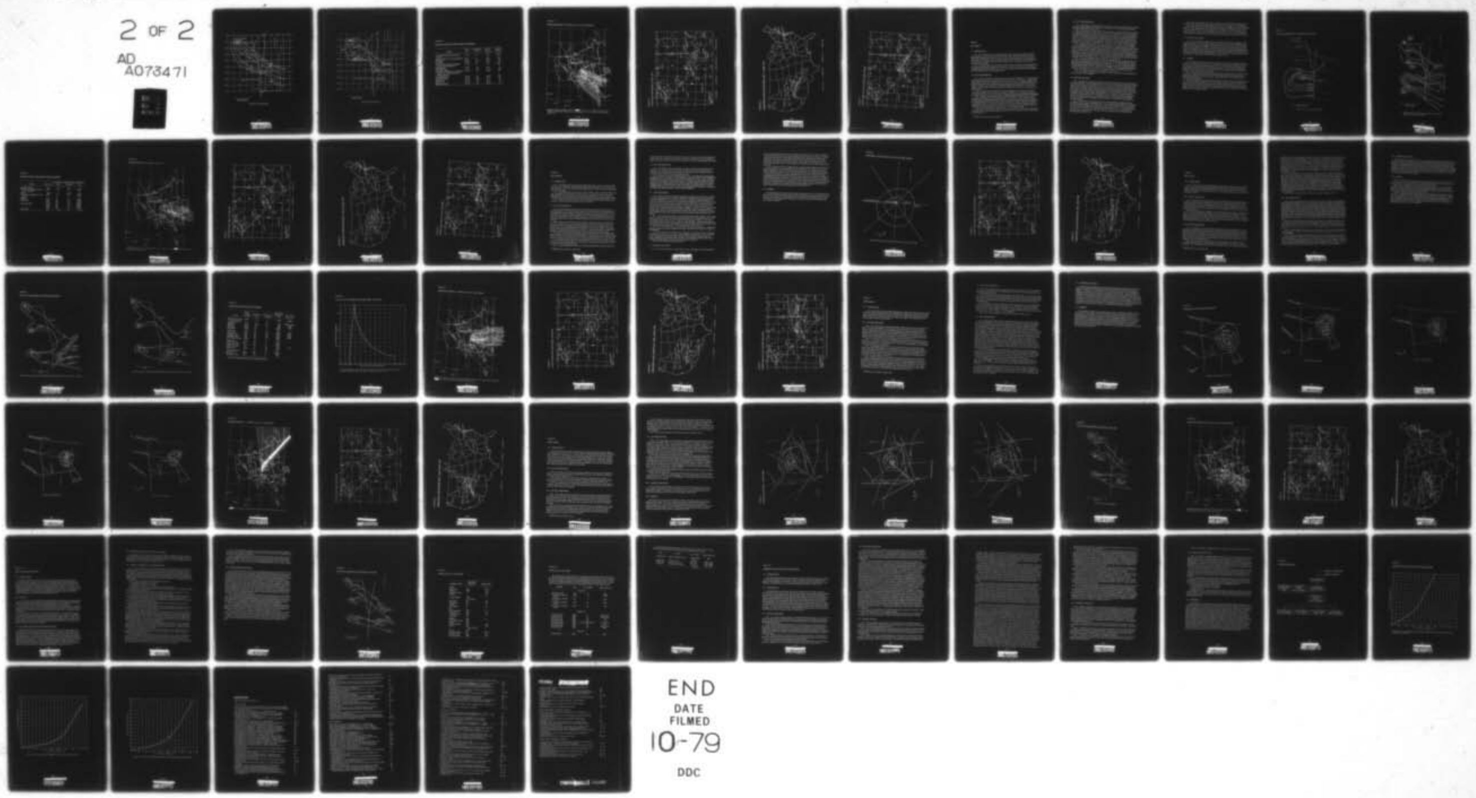
[redacted]



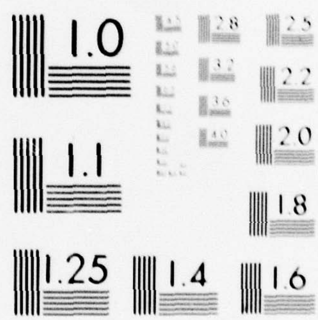
Resurvey, 0630, 19 April 1953.

AD-A073 471 DEFENSE ATOMIC SUPPORT AGENCY WASHINGTON DC F/G 6/18
OPERATION USPHOT-KNOTHOLE, NEVADA PROVING GROUNDS, MARCH - JUNE--ETC(U)
JUN 53 T D COLLISON
UNCLASSIFIED DASA-WT-817 NL

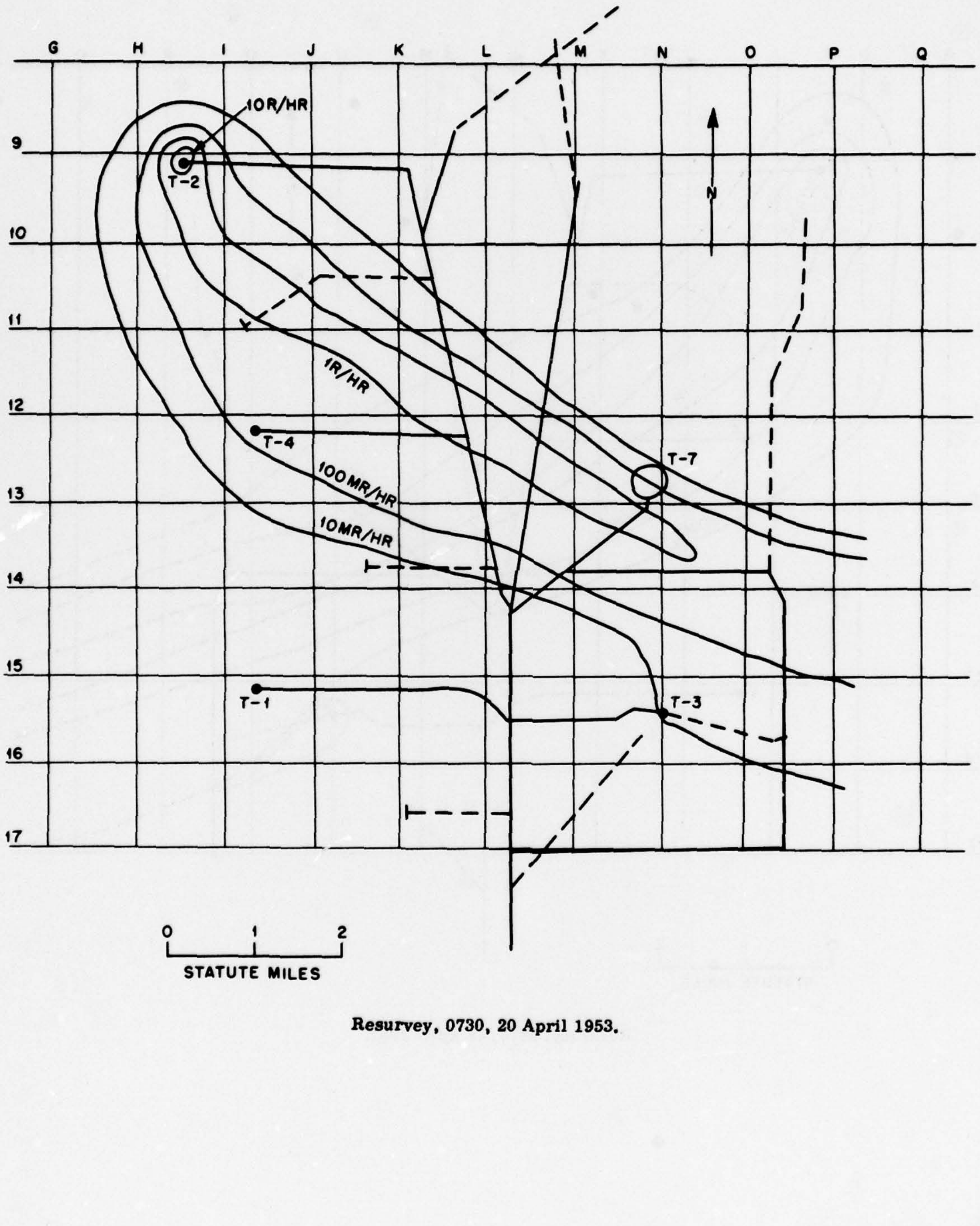
2 OF 2
AD
A073471



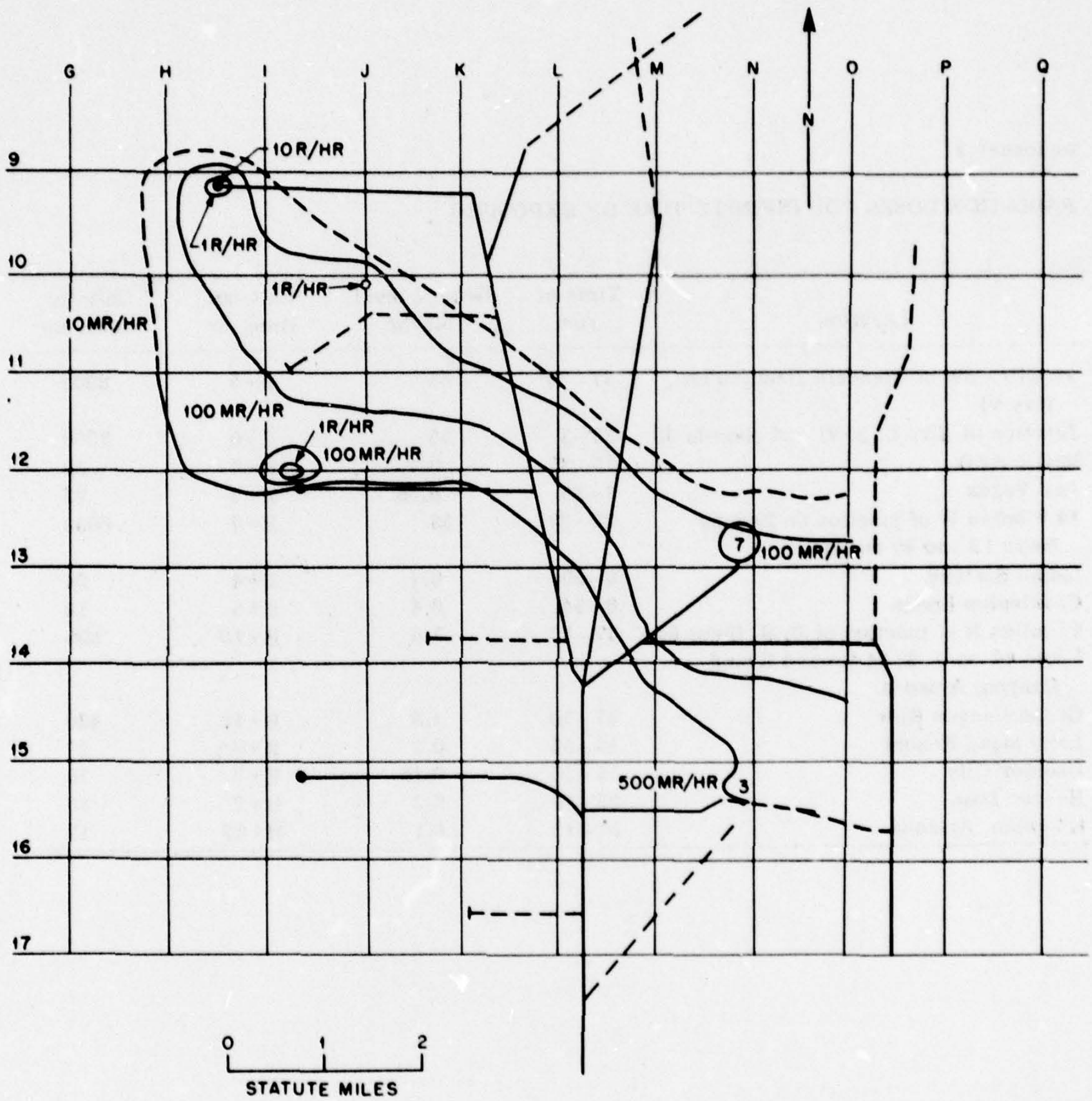
END
DATE
FILMED
10-79
DDC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



Resurvey, 0730, 20 April 1953.



Resurvey, 0730, 23 April 1953.

[redacted]

UNCLASSIFIED

Inclosure 2

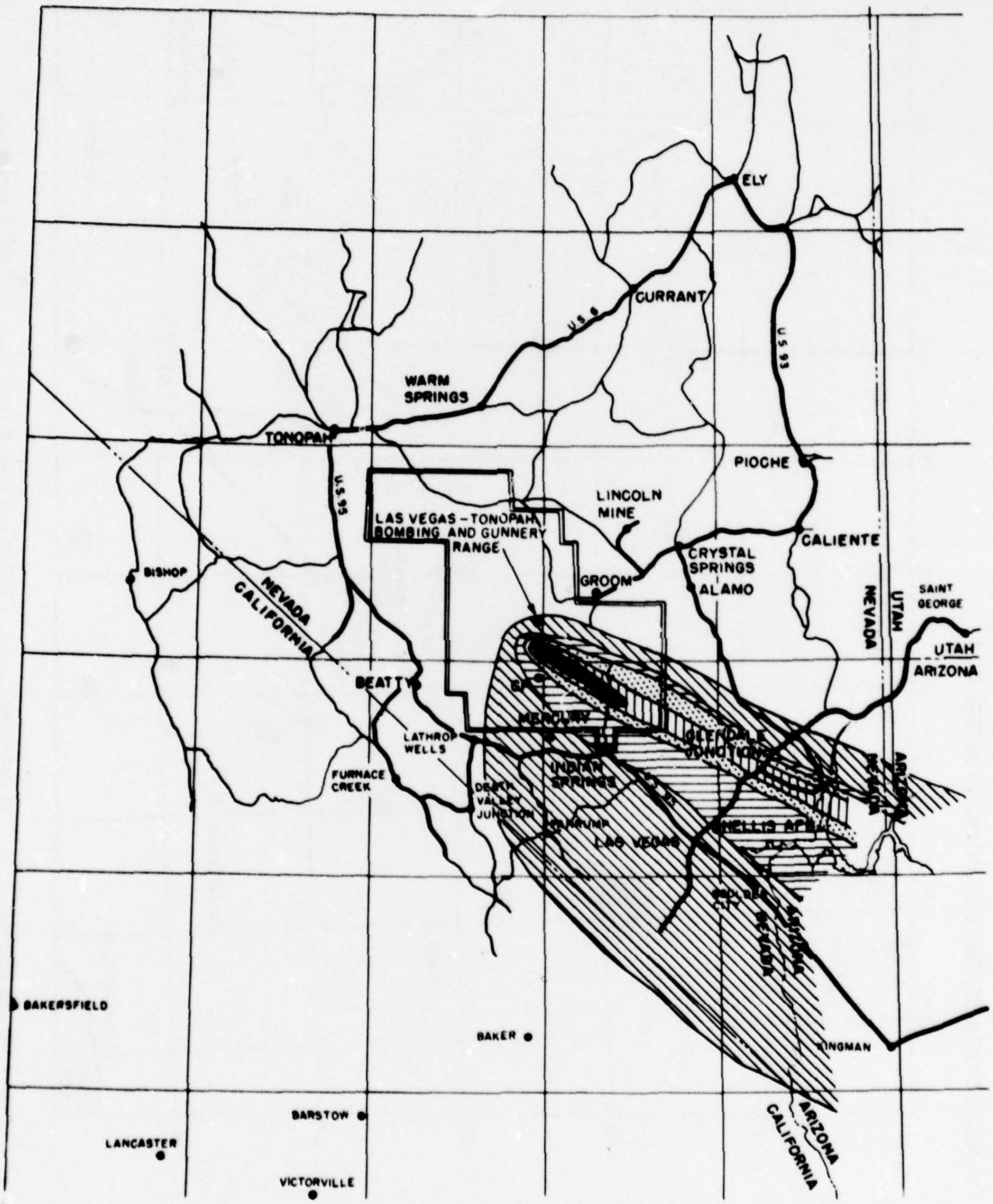
RADIATION DOSES FOR INFINITE TIME OF EXPOSURE

Location	Time of run	Ground level, mr/hr	Fall-out time, hr	Infinite dose, mr
17 miles SW of Glendale Junction on Hwy 91	31–39	38	H+5	8000
Junction of Hwy U. S. 91 and Nevada 40	28–3	35	H+6	7000
Nellis AFB	18–25	0.3	H+5	35
Las Vegas	7–25	0.65	H+5	23
14.5 miles W of junction on Nevada Hwys 12 and 40 on Hwy 40	27–23	38	H+7	6000
Indian Springs	6–29	0.7	H+4	24
Charleston Lodge	8–54	0.4	H+5	18
57 miles N of junction of U. S. Hwys 64 and 66 on U. S. 64 toward Grand Canyon, Arizona	37–18	3.5	H+10	800
Grand Canyon Rim	37–30	1.9	H+10	480
Lake Mead Resort	15–55	0.3	H+7	27
Boulder City	15–10	0.15	H+7	10
Hoover Dam	29–10	0.3	H+7	50
Kingman, Arizona	31–15	0.1	H+12	17

[redacted]

Inclosure 3

RADIATION INTENSITY AT TIME OF FALL-OUT, SHOT BADGER



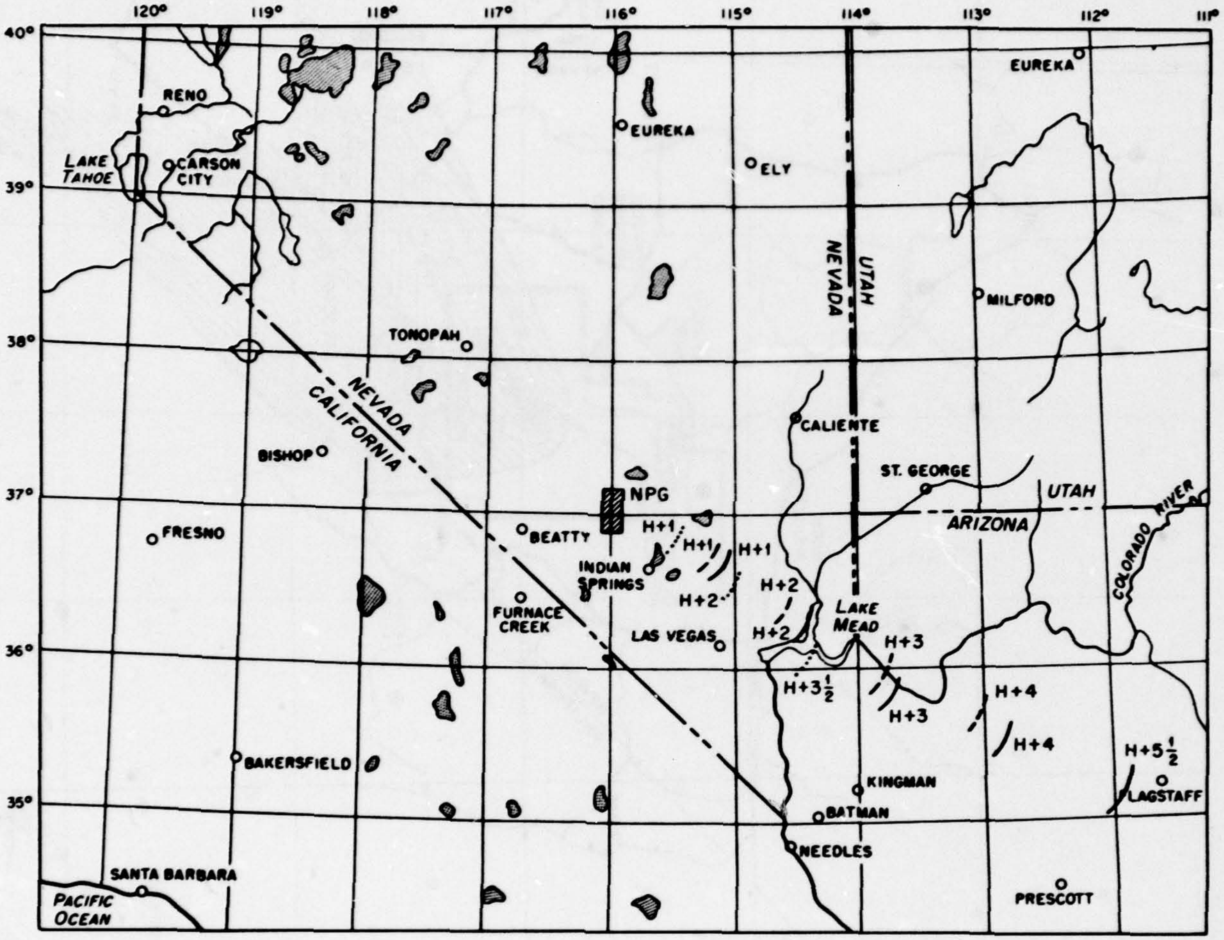
Radiation intensity, Shot Badger, April 1953. ▬, 400 mr/hr or over. ▥, 200 to 400 mr/hr. ▒, 20 to 200 mr/hr. ▤, 2 to 20 mr/hr. ▧, 0.2 to 2 mr/hr. Heavy lines indicate the monitor run.

[redacted]

UNCLASSIFIED

Inclosure 4

CLOUD TRACK, SHOT BADGER, 18 APRIL 1953



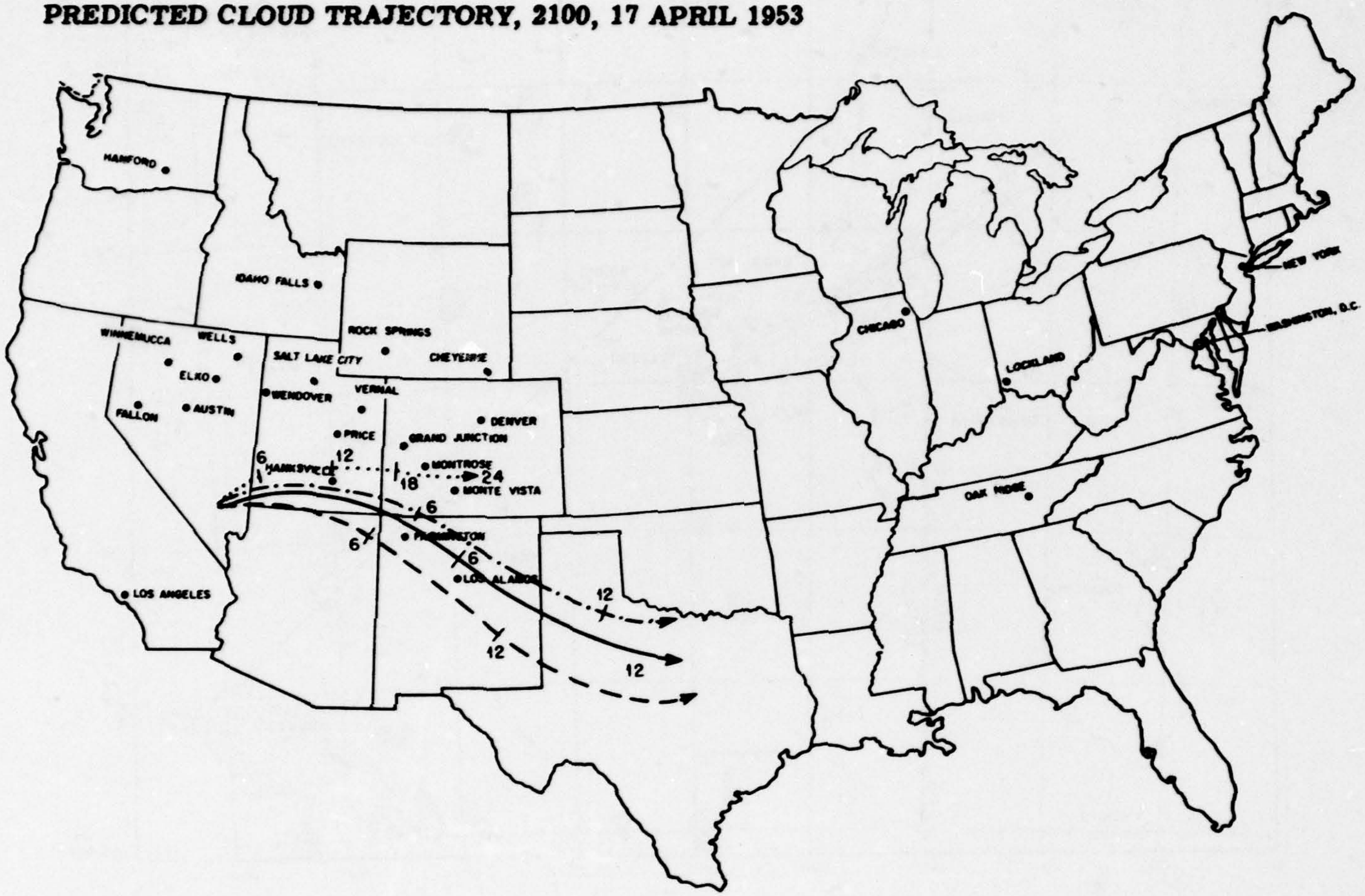
Cloud position: ...., 12,000 ft msl. ------, 18,000 to 22,000 ft msl. ———, 37,000 ft msl (top).

[redacted]

UNCLASSIFIED

Inclosure 5

PREDICTED CLOUD TRAJECTORY, 2100, 17 APRIL 1953

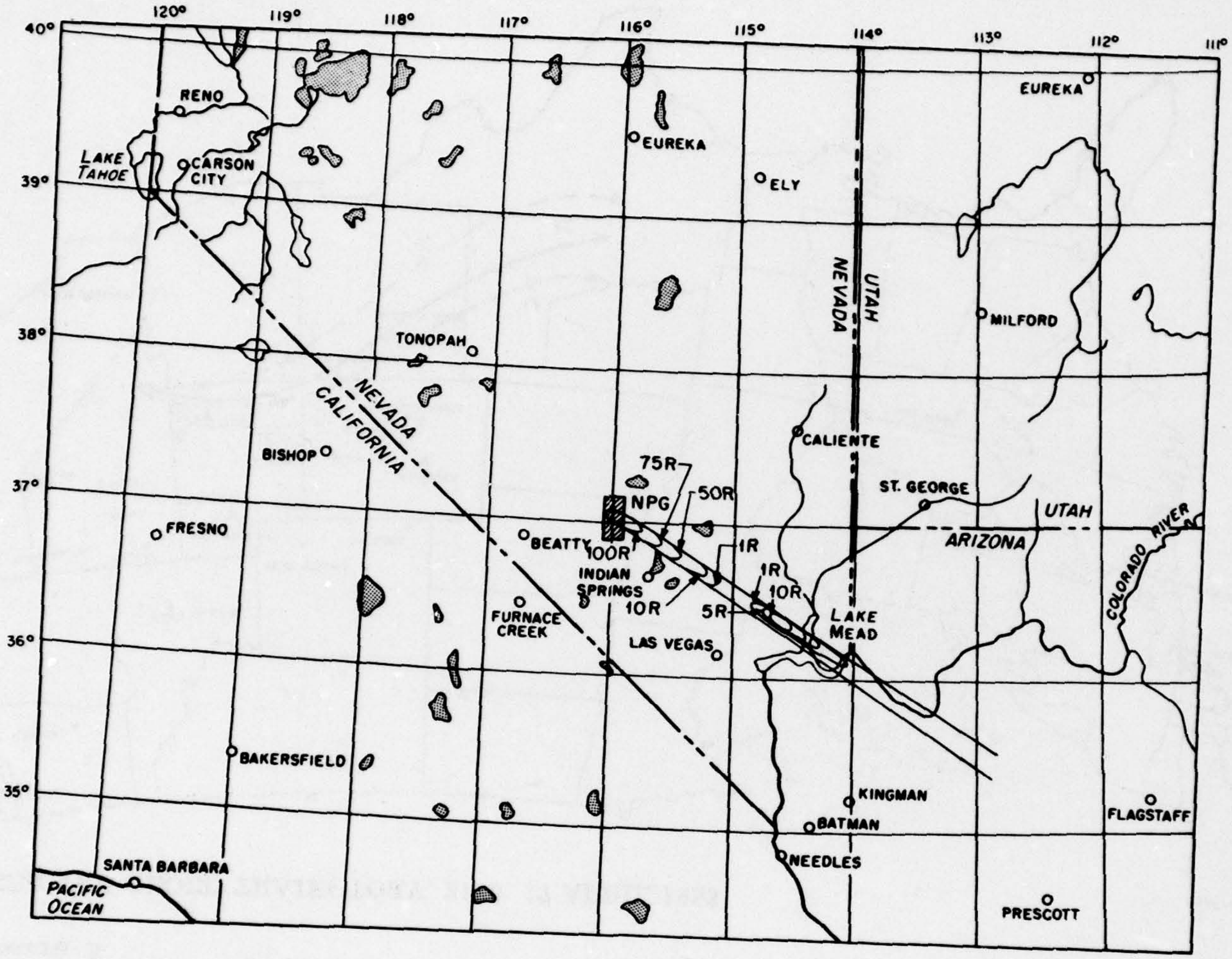


........, 10,000 ft msl. -------, 20,000 ft msl. -·-·-·-, 30,000 ft msl. ———, 40,000 ft msl.

UNCLASSIFIED

Inclosure 6

INFINITE DOSE FALL-OUT PATTERN, SHOT BADGER



Pattern based on combined air and ground survey data. 18 April 1953, Shot Badger.

Chapter 8

SHOT SIMON*

8.1 INTRODUCTION

8.1.1 The seventh shot of the Upshot-Knothole series, Simon, was detonated on a 300 ft tower in Area 1 of Yucca Flat, NPG, at 0430, 25 April 1953. The 2100 hour forecast on 24 April 1953 indicated that the fall-out would be to the southeast and would miss all populated communities. The amount of fall-out was expected to be much larger than usual; however, due to the fact that no populated communities were expected to be in its path, the decision was made to fire on schedule.

8.1.2 The On-Site ground survey began at 0450 and was completed by 0715. Extensive fall-out on access roads slowed completion of the survey. R (general recovery) hour was not announced until H + 8 hours or 1230. Prior to this time, however, the Test Director had released ten recovery parties into the contaminated area.

8.2 ON-SITE OPERATIONS

8.2.1 Two dry runs were completed and radio equipment checked by D – 1. Communications were excellent for both dry runs and the initial survey on D-day. The officer in charge of the initial survey worked out an alternate entry plan to be used in case of a weather change. Three special survey teams were organized to obtain readings at specific stations in Area 1 and in Area 3. The initial survey party left the Rad-Safe building at 0435, and the survey was completed by 0715 on D-day. R Hour was declared at 1230 by the Test Director. Survey plots are shown in Incl. 1.

8.2.2 A check point was established on Mercury Highway on D-day near the 10 mr/hr line. Owing to traffic in the area this check point was maintained in continuous operation for the period of this report. All entry roads to contaminated areas were posted with warning signs.

8.2.3 Dosimetry and Records processed 1,880 film badges during this period. A total of 39 persons exceeded the 3.9 r permissible dosage on D-day and D + 1 day. Eleven of these persons were in a B-29 working for Project 6.2. A comparison of film badge to pocket dosimeter readings showed that the film badge read generally twice as high as the pocket dosimeter for this period. On D + 2 the pocket dosimeter and film badge readings compared normally. An investigation of these discrepancies in dosimeter and film badge readings is being made; however, no fault was found with the pocket dosimeter or film badge procedure.

8.2.4 A total of 789 persons in 262 parties were processed during the period. The vehicle decontamination section decontaminated one hundred two (102) vehicles, one electric generator, and two photo vans.

*Period covered, 24 April to 2 May 1953.

8.3 OFF-SITE OPERATIONS

8.3.1 The changes in the anticipated fall-out pattern resulting from Shot Simon are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705).

8.3.2 The movement of mobile equipment and personnel to provide additional coverage in the anticipated path is described in Incl. 2, Chap. 8, of WT-702(REF.). It is to be noted that a new experience in Off-Site operations was encountered from heavy fall-out on public highways resulting in contamination of vehicles traversing the fall-out path. This influenced the Test Director to order the establishment of roadblocks and decontamination stations at North Las Vegas, Alamo, and St. George. The pertinent information concerning these roadblocks is also included in Incl. 2, Chap. 8, of WT-702(REF.). A detailed report of this experience was prepared at the request of the Test Director, and is shown as Incl. 3, Chap. 8, of WT-702(REF.).

8.3.3 Significant ground levels were detected along U. S. Highways 93 and 91 between Alamo and the approaches to St. George. A documentation of ground monitoring results is given in Incl. 4, Chap. 8, of WT-702(REF.). Maximum fall-out occurred in the region from 15 to 20 miles north of Glendale Junction on Highway 93 and 10 to 20 miles east of Glendale Junction on Highway 91. A report of a special survey of this area for inhabitants, domestic animals, and other pertinent data has been compiled in Incl. 5, Chap. 8, of WT-702(REF.). Infinite doses for localities of interest are given in Incl. 2. As noted on Shot Badger, the monitoring logs indicate a duration of fall-out considerably longer than previously encountered.

8.3.4 Air sampling results confirm the pattern of paragraph 8.3.3. In addition, the communities of St. George, Alamo, Caliente, Pioche, Mercury, CP, Crystal Springs, Ely, Groom Mine, and Beatty all showed significant air concentrations ($>10^{-4}$ $\mu c/M^3$ on a 24-hr average) to indicate that widespread airborne contamination resulted from this shot. A tabulation of air concentrations is given in Incl. 7, Chap. 8, of WT-702(REF.). The inhabited areas in the above Inclosure were subjected to a later fall-out than was anticipated from available wind data.

8.3.5 The pictorial presentation of the pattern is shown in Incl. 3.

8.3.6 The results of water samples analyzed for fission product activity are presented in Incl. 9, Chap. 8, of WT-702(REF.).

8.4 AIR PARTICIPATION

8.4.1 The high level winds were toward the northeast, whereas the lower level winds were toward the southeast. Recommendations were made to close the air space in the sector bounded by the 0° and 80° vectors from ground zero out to a distance of 100 miles at all altitudes from 0400 to 0730. In addition, the air space in the sector bounded by the 80° and 180° vectors from ground zero to the west boundary of Amber 2 airway was recommended closed at all altitudes from 0400 to 0730. The opening time was changed from 0730 to 0930 at H+2 hours. The sector bounded by the 180° and 360° vectors through west out for a radius of 50 miles was recommended closed from 0400 to 0530. A high altitude sector at 24,000 ft msl and up bounded by a line from Las Vegas to Winslow to Fort Bridger to Elko to Las Vegas was recommended closed from 2400 to 1200. A warning circle with a radius of 170 miles from Las Vegas was also recommended.

8.4.2 The two B-29 cloud trackers were off from Kirtland AFB on schedule, but one aborted the mission owing to mechanical failure. The remaining B-29 and the B-25 tracked the cloud at 22,000 and 12,000 ft msl, respectively. The data from these aircraft are given in Incl. 10, Chap. 8, of WT-702(REF.). These data are plotted as shown in Incl. 4. The predicted path is shown in Incl. 5. The top of the cloud was reported at 43,200 ft msl. Its position was reported by cloud sampling aircraft. The top of the cloud was last reported some 225 miles east southeast of ground zero.

[redacted]

8.4.3 The close-in aerial survey was performed by a helicopter which took off from the CP at H+10 min. The data from this flight are given in Incl. 13, Chap. 8, of WT-702(REF.).

8.4.4 The L-20 and C-47 performed the terrain survey. Although the C-47 did not take off until H+4 hr, it picked up some air contamination. The pattern and data from the L-20 and the C-47 are given in Incls. 14 and 15, Chap. 8, of WT-702(REF.). A D+1 day survey was made in the C-47. The data from this flight are listed as Incl. 16, Chap. 8, of WT-702(REF.). A plot of the fall-out area made from these data and ground monitor's data is given in Incl. 6.

8.5 LOGISTICS AND SUPPLY

8.5.1 For this period, the Supply Section issued 316 protective caps, 359 pairs of shoe covers, 308 pairs of coveralls, 283 respirators, 327 pairs of cotton gloves, 186 high intensity goggles, and 32 pairs of clear goggles. The laundry serviced 170 protective caps, 951 pairs of shoe covers, 702 pairs of coveralls, 252 respirators, 551 pairs of cotton gloves, and 158 towels. The laundry also serviced one (1) bag of contaminated clothing for Indian Springs and 84 pieces of personal contaminated clothing. The instrument repair section issued 124 survey instruments and repaired and calibrated 92 instruments. Weekly maintenance was performed on 31 vehicles. Three vehicles were deadlined during the period.

8.6 GENERAL

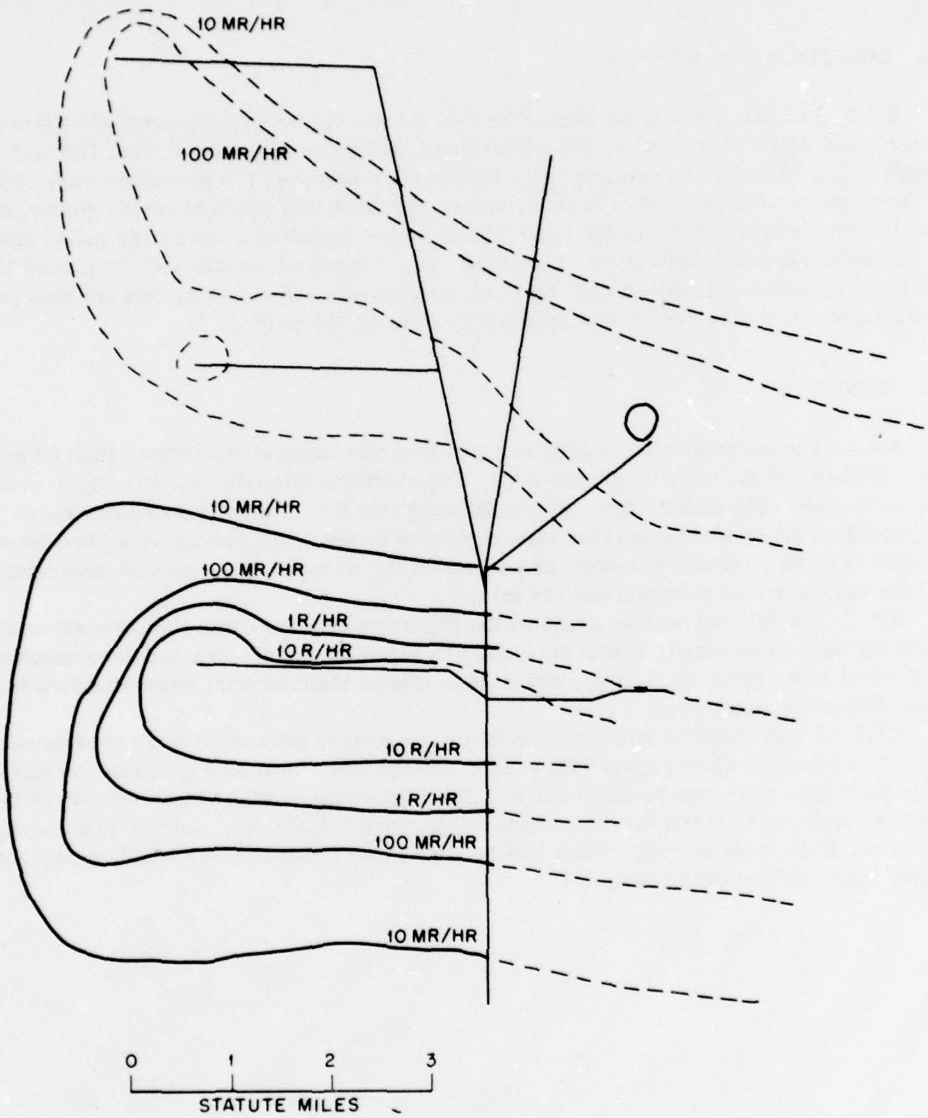
8.6.1 The general fall-out area for this shot was narrow, no greater than 20 miles wide at more than 200 miles from ground zero. The radiation intensity was very high even at the 250 mile limit. The infinity dose at this distance was 5 r. The only locations where fall-out hit populated areas were a service station west of Bunkerville, Bunkerville, and Mesquite, Nevada. The 25 r infinity iso-dose line extended for 60 miles from ground zero, and the 10 r infinity iso-dose line extended for 110 miles.

8.6.2 The fall-out was so great on the highways near Glendale that several vehicles were found highly contaminated. It was necessary to establish roadblocks and decontamination stations at Las Vegas, St. George, and Alamo. These stations were very effective in their decontamination processes.

8.6.3 A considerable number of monitor and project personnel were overexposed on this shot. The pocket dosimeter and T1B survey meters were used as a guide by the monitors to judge their stay in the contaminated area. The film badge readings, however, gave in some cases a value two to three times as large as the pocket dosimeter and the T1B survey meter indicated. Data from previous shots had indicated that the dosimeter readings were generally higher than the film badge readings.

Inclosure 1

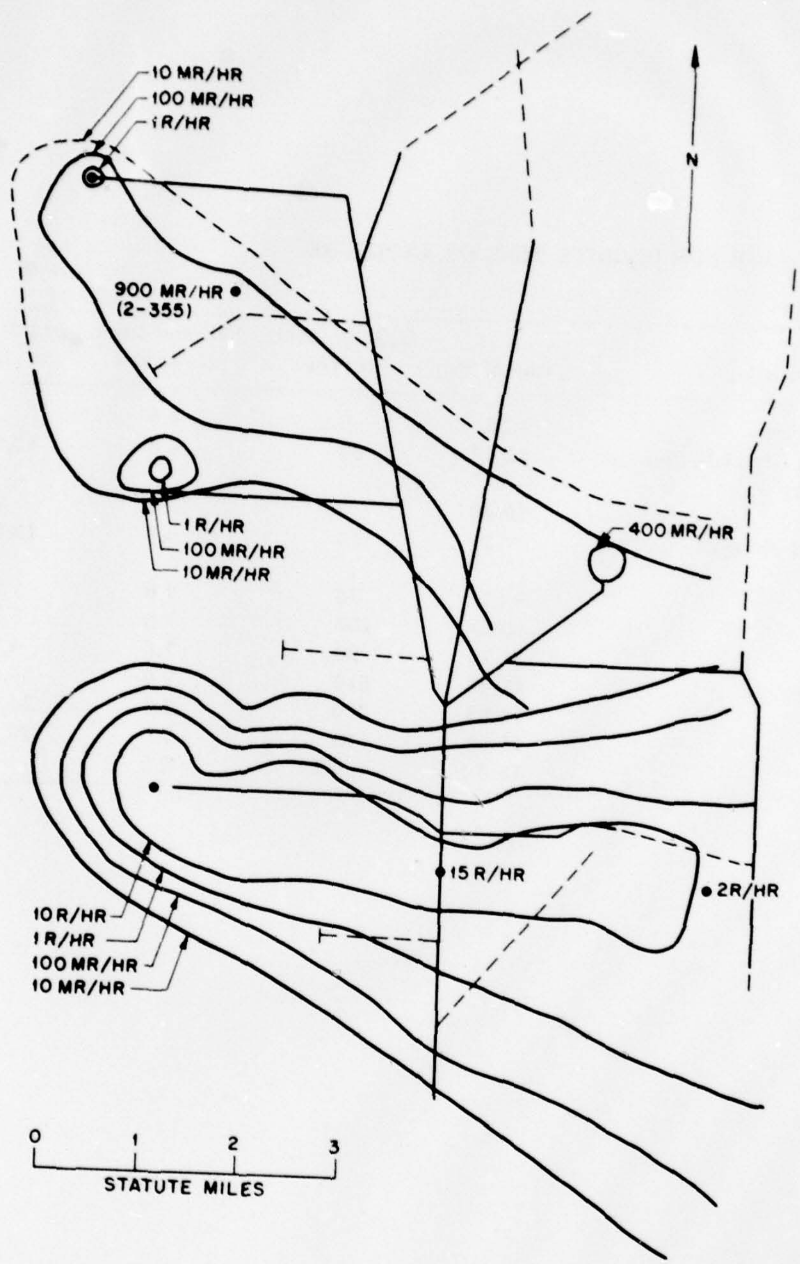
YUCCA FLAT RADIOLOGICAL SITUATION, SHOT SIMON



Initial survey, 0730, 25 April, Shot Simon.

[redacted]

UNCLASSIFIED



Resurvey, 1500, 25 April, Shot Simon. Resurvey, 1500, 25 April, Shot Badger, H-hour, 0435, 18 April.

[redacted]

UNCLASSIFIED

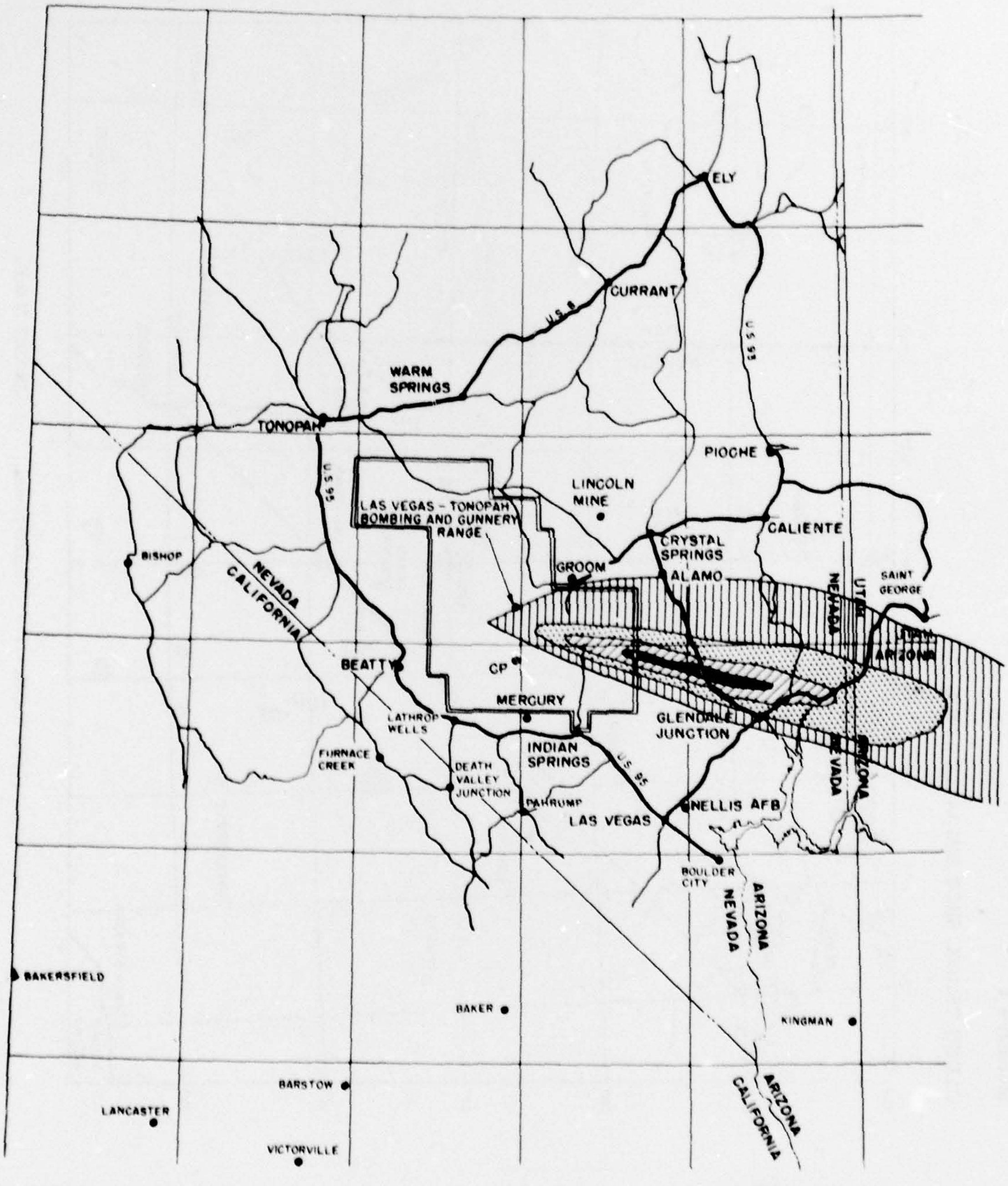
Inclosure 2

RADIATION DOSAGE FOR INFINITE TIME OF EXPOSURE

Location	Time of run	Ground level, mr/hr	Fall-out time, H+hours	Infinite dose, mr
Glendale Junction	7:15	0.5	4.5	19
20 miles N of Glendale Junction on U. S. Hwy 93	28:57	80	4.5	12,500
Alamo	10:40	1.8	10.12	100
24 miles W of Mesquite on U. S. Hwy 91	27:30	110	6.0	12,000
Mesquite	9:51	30	7.0	1,500
Bunkerville	10:21	100	7.0	5,000
	34:10	20	7.0	4,800
Riverside Cabins	12:42	210	7.0	14,000
	10:05	300	7.0	15,000
	15:25	170	7.0	15,000
Groom Mine	13:0	0.20	8.5	12.5

Inclosure 3

RADIATION INTENSITY AT TIME OF FALL-OUT

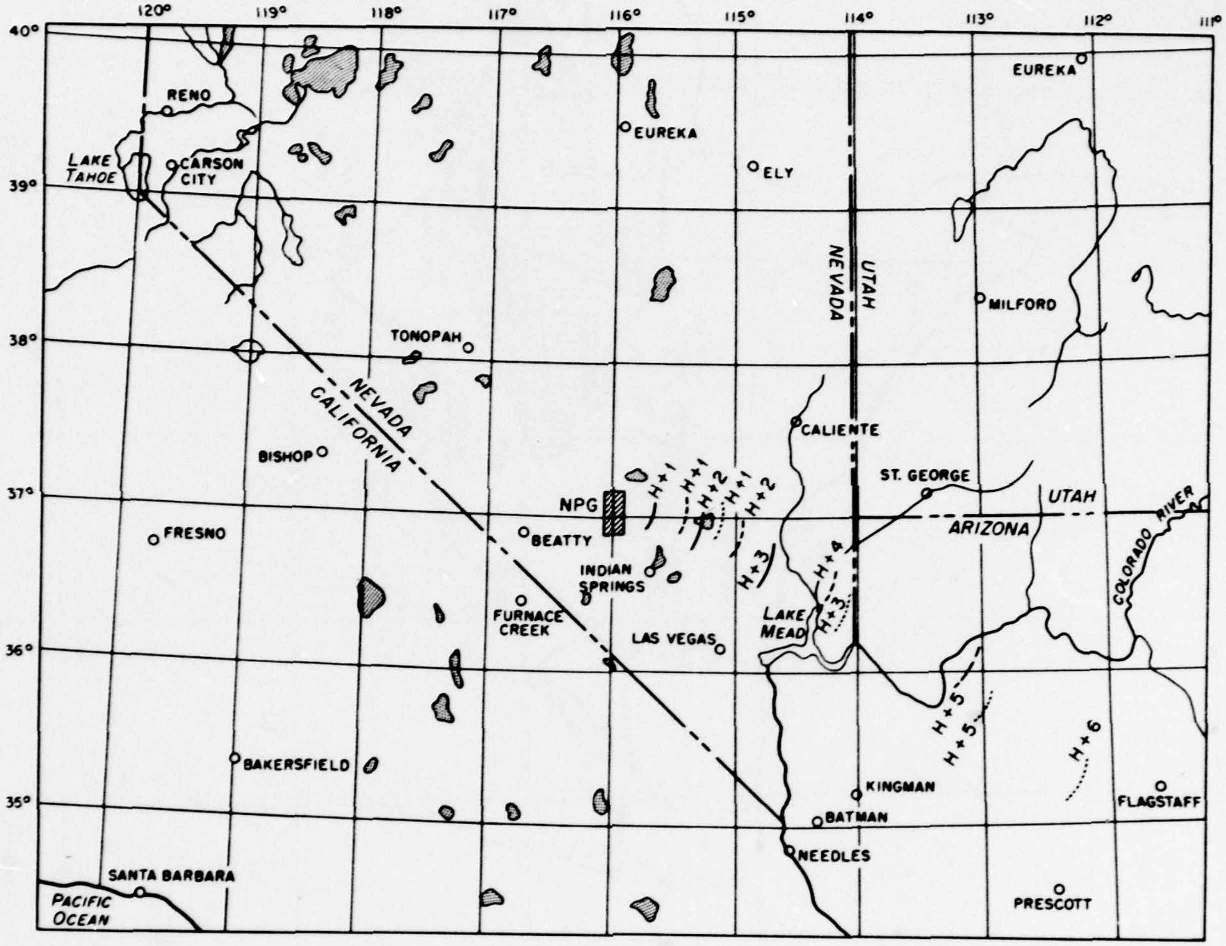


[vertical hatching], 2 to 20 mr/hr. [dotted], 20 to 200 mr/hr. [diagonal hatching], 200 to 400 mr/hr. [solid black], 400 mr/hr. Heavy lines show the monitoring runs.

[redacted]

Inclosure 4

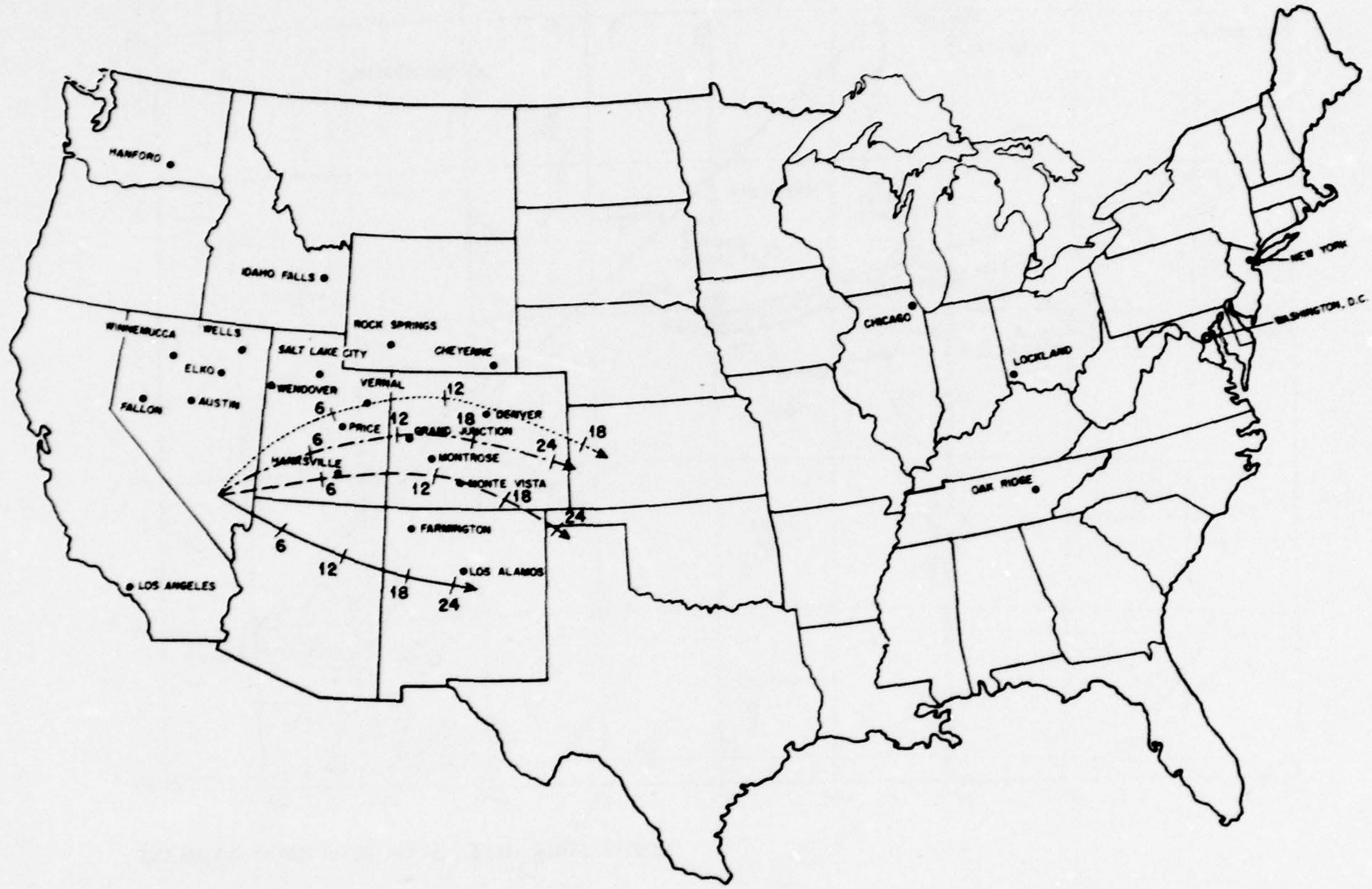
CLOUD TRACK, SHOT SIMON, 25 APRIL 1953



——, 12,000 ft msl. - - - - - -, 22,000 ft msl. . . . ., 40,000 ft msl.

Inclosure 5

PREDICTED CLOUD TRAJECTORY, 2100, 24 APRIL 1953



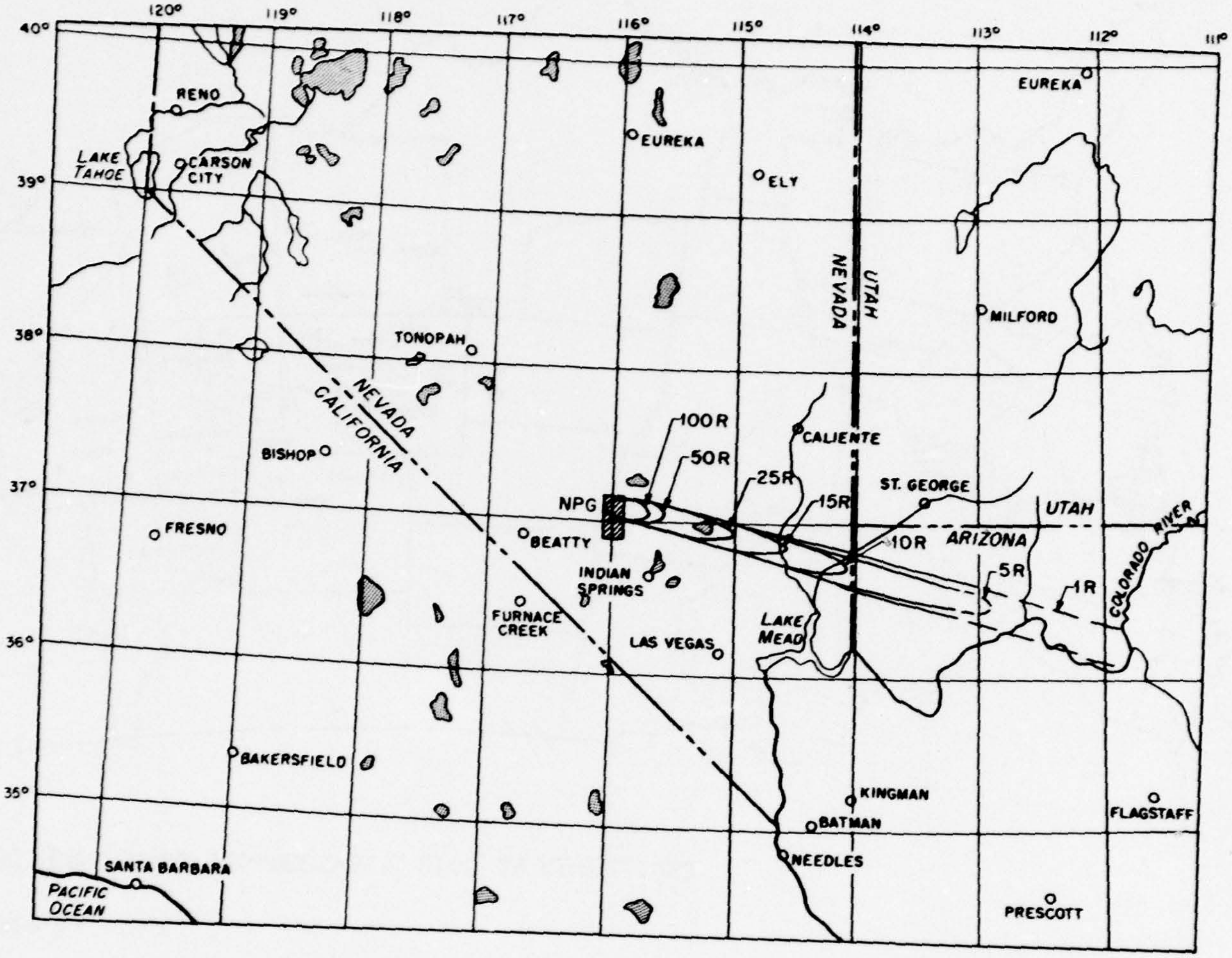
———, 10,000 ft msl. - - - - - - -, 20,000 ft msl. · · · · · · · ·, 30,000 ft msl. —·—·—·—, 40,000 ft msl.

[redacted]

UNCLASSIFIED

Inclosure 6

INFINITY DOSE FALL-OUT PLOT, SHOT SIMON



Plot based on combined air and ground survey data, 25 April 1953, Shot Simon.

[redacted]

Chapter 9

SHOT ENCORE*

9.1 INTRODUCTION

9.1.1 The eighth shot of the Upshot-Knothole series, Encore, was an air drop at about 2400 ft over the Frenchman Flat area, NPG, at 0830 PDT, 8 May 1953. The decision to drop was made after a 24 hr delay caused by unfavorable weather conditions. The prevailing winds were to the northeast.

9.1.2 The initial On-Site ground survey started at 0857 and was completed at 0928. Only light contamination was encountered during the survey. R (general recovery) hour was announced at 0919. Prior to this time, one party was released into the area by previous arrangement with the Test Director. Mercury Highway was declared open to all traffic at 0930.

9.1.3 The period covered by this chapter is from 3 May 1953 to 15 May 1953, which is from D−1 for Dry, a dry run for Encore, to D−1 for Harry.

9.2 ON-SITE OPERATIONS

9.2.1 The On-Site Section operated in Frenchman Flat during Dry and Shot Encore as long as Rad-Safe control of the area was required. On D-day for Encore an assembly point was established at the old Ranger CP and was manned by personnel from the Dosimetry and Records Section, Plotting and Briefing Section, and Vehicle Decontamination Section. As soon as the road was declared clear, at approximately H+20 min, all sections moved into their respective positions at the junction of Mercury Highway and the main access road to Frenchman Flat.

9.2.2 Hickory 4, the On-Site sedan, was used as a mobile control in Frenchman Flat; Hickory 1, located in CP No. 2, acted as the control for activities continuing in Yucca Flat area and also recorded messages directed to Hickory 4. In this way readings taken by the survey teams were recorded and plotted simultaneously at the control station in Frenchman Flat and in the Plotting and Briefing room in CP No. 2. This made accurate information immediately accessible to personnel in both the CP area and the Frenchman Flat area.

9.2.3 The initial survey of Frenchman Flat was completed by H + 58 min, 0928, 8 May 1953. At 0900 D-day, the reading at GZ was 300 mr/hr. At 1300 D-day, the reading at GZ was 110 mr/hr. On D+1 the general area around GZ was reading around 10 mr/hr, and Rad-Safe control was lifted from the entire area. The results of the initial survey are shown in Incl. 1.

9.2.4 During this period there was considerable activity in the Yucca Flat area. Parties were processing both day and night into the area, and it was necessary to assign three standby monitors to parties working at night.

9.2.5 A total of 890 parties have been processed through Rad-Safe facilities during this

*Period covered, 3 May to 15 May 1953.

reporting period. The majority of these personnel were construction workers from Reynolds Electric who were working in Areas 3A and 7. Dosimetry and Records processed 4500 film badges during the period, and the Vehicle Decontamination Section decontaminated 104 vehicles.

9.3 OFF-SITE OPERATIONS

9.3.1 The changes in the anticipated fall-out pattern resulting from the detonation are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705). By shot time, the area of primary interest became the sector between St. George and Milford, Utah.

9.3.2 No ground levels were detected from this shot. A documentation of ground monitoring is given in Incl. 2, Chap. 9, of WT-702(REF.). Inclosure 3, Chap. 9, of WT-702(REF.), is a tabulation of air concentrations encountered from this detonation. It is evident from these results that no detectable activity greater than 10^{-4} $\mu c/M^3$ was collected by any of the equipment in use by the Off-Site group. One air sample containing sufficient activity for decay investigation was collected at Hurricane, Utah. The decay of this sample taken to D+4 days indicated origin prior to Shot Encore. The results of water samples analyzed for fission product activity are presented in Incl. 4, Chap. 9, of WT-702(REF.).

9.4 AIR PARTICIPATION

9.4.1 Weather information resulted in closing the air space at all levels out to a radius of 70 miles from ground zero from 0800 to 0930 PDT. In addition, the air space inclosed by the sector bounded by the 75° vector out to a distance of 495 miles (changed at 0800 to 50° vector out to Utah border) and the 125° (changed to 100° at 0800) vector out to a distance of 245 miles was closed at 24,000 ft msl and below from 0900 to 1430 PDT except Amber 2 and all air space west which was opened at 1130 PDT. The air space inclosed by a line from Las Vegas to Ely to Goodland (changed to North Platt at 0800) to Amarillo to Prescott to Las Vegas was also closed above 24,000 ft msl from 0900 to 1500 PDT. A warning circle of 290 mile radius of Bryce Canyon was recommended from 0800 to 1430 PDT. At 1130 PDT the air space below 24,000 ft msl was cleared, as well as all air space above 24,000 ft msl south of 37° N latitude.

9.4.2 The two B-29 cloud trackers were off from Kirtland AFB on schedule. One of them, however, aborted the mission owing to mechanical failure. The remaining B-29 and the B-25 from Indian Springs tracked the cloud at 22,000 and 12,000 ft msl, respectively. The data from these aircraft are given in Incl. 5, Chap. 9, of WT-702(REF.). Included in this inclosure are the data on the top of the cloud (40,500 ft msl) from the B-50 sampler control aircraft. The cloud track data are plotted in Incl. 2. The predicted path is given in Incl. 3.

9.4.3 The close-in aerial survey was performed by helicopter as planned. Communication difficulties prevented rapid transmission of the data. The data are shown as Incl. 8, Chap. 9, WT-702(REF.).

9.4.4 The L-20 and C-47 performed the terrain survey as in previous shots. Their data are presented as Incls. 9 and 10, Chap. 9, of WT-702(REF.), respectively. The C-47 mission was not completed owing to bad weather conditions which affected the safety of flight. No ground contamination was found by either aircraft. A low reading was obtained when the aircraft passed through some low scud which was hanging in the valleys.

9.4.5 No plot of Off-Site fall-out was made.

9.5 LOGISTICS AND SUPPLY

9.5.1 For the period 3 May to 15 May 1953, inclusive, the Supply Section issued 882 pro-

tective caps, 1314 pairs of shoe covers, 1254 pairs of coveralls, 561 respirators, 1306 pairs of cotton gloves, 541 pairs of high intensity goggles, and 38 pairs of clear goggles. The laundry serviced 537 protective caps, 2239 pairs of shoe covers, 1487 pairs of coveralls, 617 respirators, 1627 pairs of cotton gloves, and 104 towels. One hundred eighty-three (183) instruments were issued, and 138 were repaired. Twenty-three (23) instruments were repaired for Camp Desert Rock. Five (5) vehicles were deadlined for radio maintenance during the period.

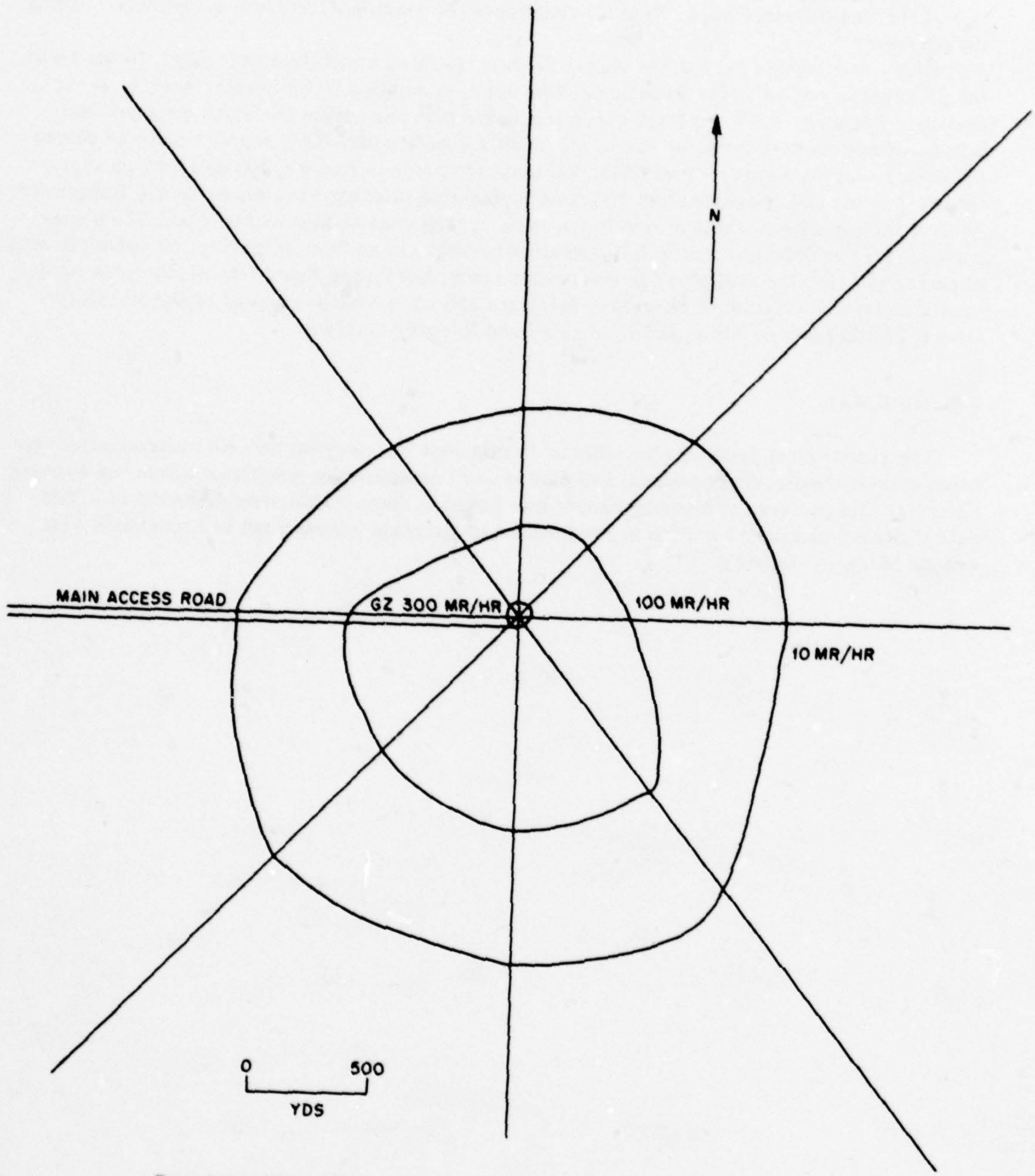
9.5.2 During this period, the Supply Section operated a mobile supply point, located with the processing station in the Frenchman Flat area, in addition to its regular service at the Rad-Safe Building. A $2\frac{1}{2}$ ton N135 cargo truck was borrowed from the 412th Engineer Battalion at Camp Desert Rock for use by the mobile supply point. This supply team was placed in operation at the Ranger CP at 0645. Immediately prior to Encore, 100 pairs of high intensity goggles and approximately 50 sets of protective clothing were issued at the Ranger CP. At 0900 the supply point was moved to the main access road to Frenchman Flat. The supply point arrived at 0920 and was in full operation by 0930. In addition to having 100 complete sets of protective clothing available for emergency issue, the Supply Team was responsible for the supply and transportation of necessary furniture and equipment in support of On-Site Operations, Plotting and Briefing, and Dosimetry and Records Sections.

9.6 GENERAL

The radiological problem encountered in this shot was very minor. No contamination was found outside the Proving Grounds, and only minor contamination was found within the Proving Grounds. The problem of clearing people into the area required the establishment of a Rad-Safe plotting and briefing station at the junction of the main access road to Frenchman Flat and the Mercury Highway.

Inclosure 1

FRENCHMAN FLAT RADIOLOGICAL SITUATION, SHOT ENCORE

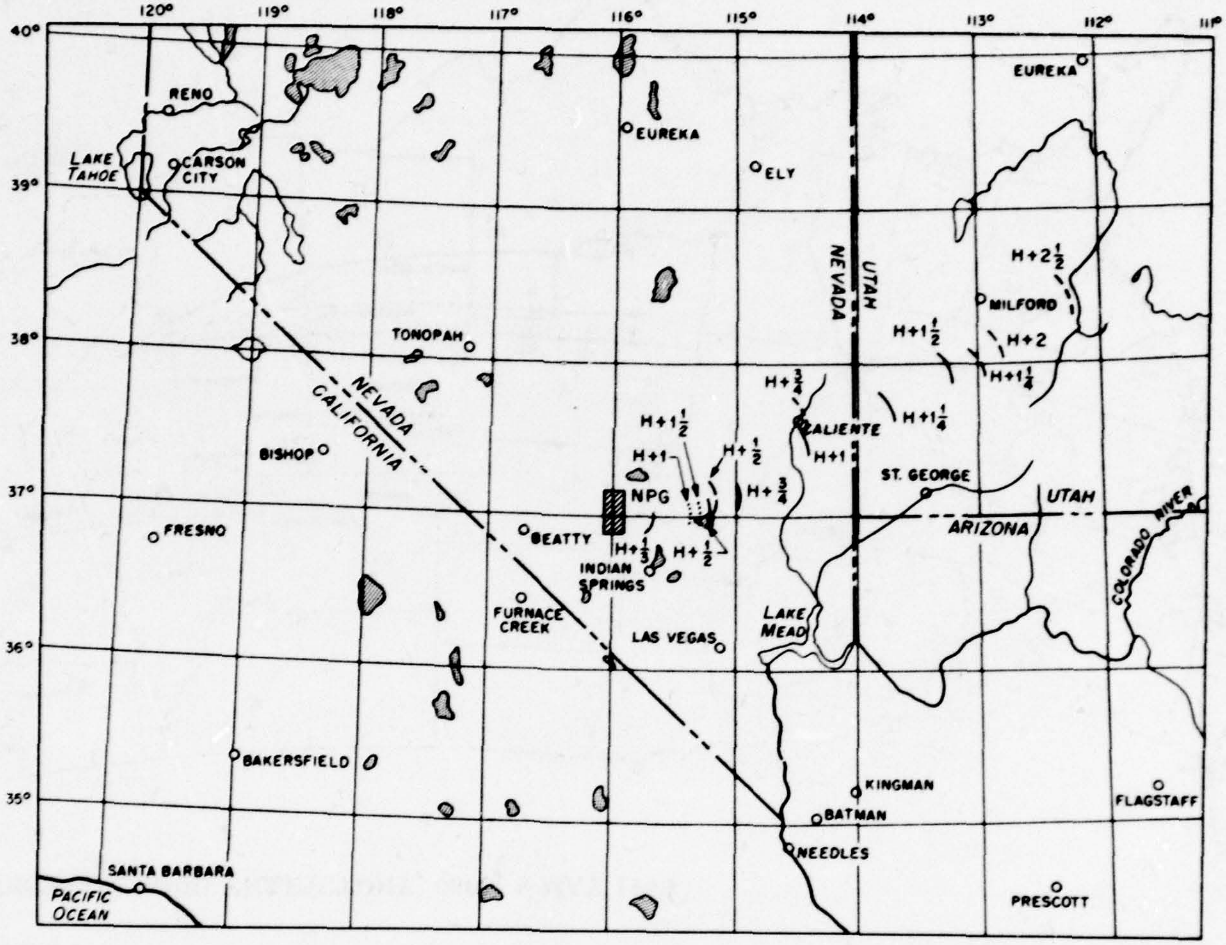


Frenchman Flat initial survey, 0900, 8 May 1953. H-hour, 0830, 8 May 1953.

[redacted]

Inclosure 2

ACTUAL CLOUD TRACK, SHOT ENCORE, 8 MAY 1953



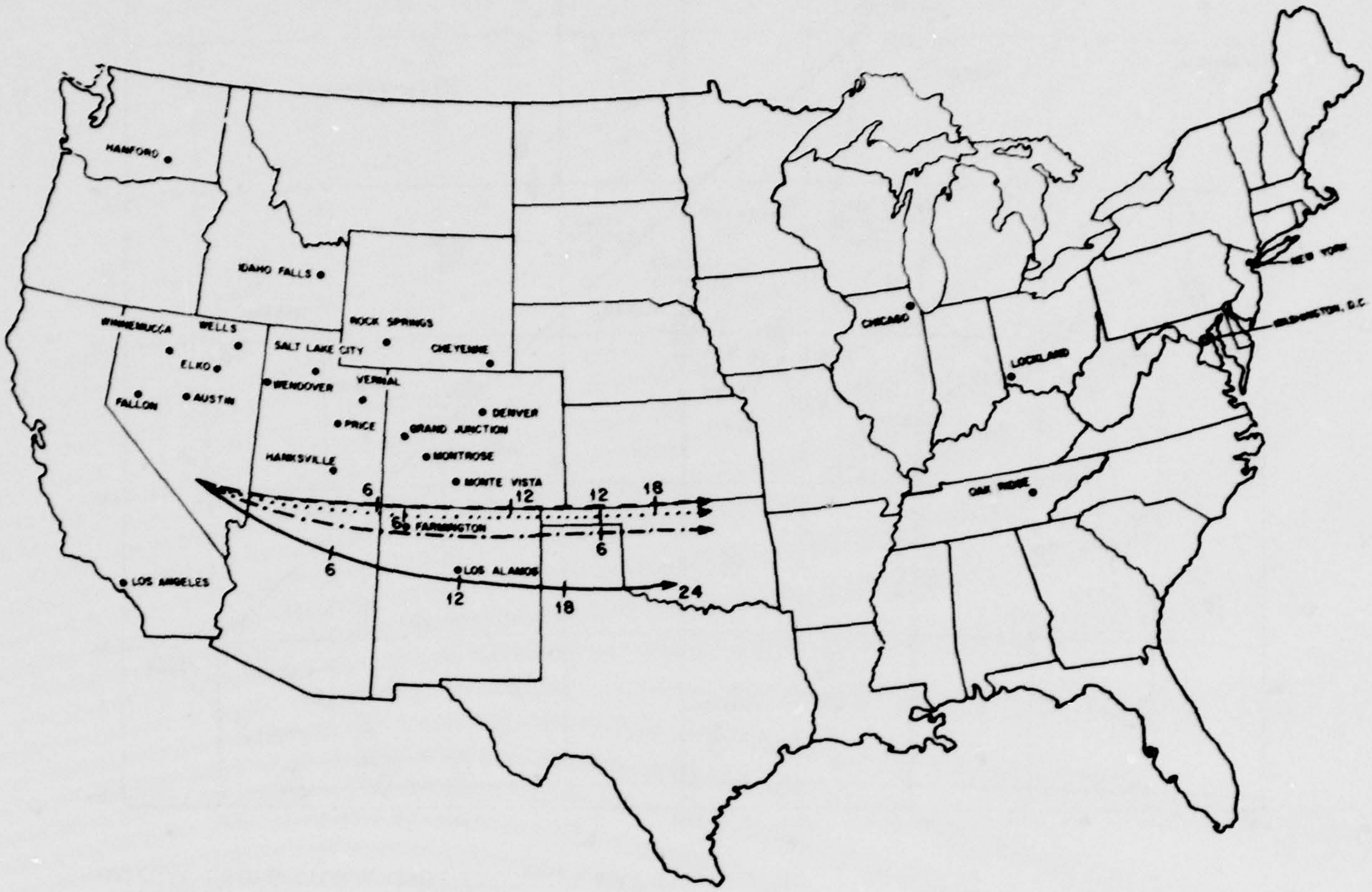
......., 12,000 ft msl. ———, 22,000 ft msl. - - - - - -, 40,000 ft msl.

[redacted]

UNCLASSIFIED

Inclosure 3

PREDICTED CLOUD TRAJECTORY, 0800, 8 MAY 1953



———, 10,000 ft msl. ...., 20,000 ft msl. - - - - - - -, 30,000 ft msl. -.-.-.-, 40,000 ft msl.

[redacted]

Chapter 10

SHOT HARRY*

10.1 INTRODUCTION

10.1.1 The ninth shot of the Upshot-Knothole series, Harry, was detonated on a 300 ft tower in Area 3A, Yucca Flat NPG, at 0505 PDT, 19 May 1953. The period covered by this chapter is from 16 May to 24 May 1953. The decision to fire was made after a 72 hr delay. Areas to the southeast which had been subject to fall-out from previous shots were in the predicted fall-out path.

10.2 ON-SITE OPERATIONS

10.2.1 The initial On-Site ground survey started at 0535 and was completed by 0640. Extensive contamination was encountered during the survey, and iso-intensity lines were not closed in the Yucca Flat area. R (general recovery) hour was announced at 0631 for all except two projects. One party was released prior to R hour. Mercury Highway was declared open to all traffic at H+45 min. The initial survey and a subsequent survey during this period are inclosed as Incl. 1.

10.2.2 Fourteen hundred film badges were processed during this period, and 350 parties were processed through On-Site Operations. Fifty-seven (57) trucks, 16 sedans, 5 jeeps, 3 buses, 1 carry-all, 1 station wagon, 1 fifty-ton tractor and trailer, and 1 bulldozer, a total of eighty-five (85) vehicles, were decontaminated during the period. A party of three (3) monitors was dispatched on D-day to Las Vegas to assist the Las Vegas Field Office in decontaminating vehicles that had been caught in the fall-out area.

10.3 OFF-SITE OPERATIONS

10.3.1 The changes in the anticipated fall-out pattern resulting from Shot Harry are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705). The movement of personnel and equipment to provide maximum coverage in the communities in the fall-out path is described in the events listed in Incl. 2, Chap. 10, of WT-702(REF.). This disposition of mobile teams was made with a certain degree of hesitancy owing to the conflicting nature of the low-level cloud tracker reports and the pattern of the Air Weather Reports.

10.3.2 Fall-out occurred over a wide sector, with the highest levels being recorded on U. S. Highway 93 between Alamo and Glendale Junction; St. George, Utah; and the area east of St. George. The Test Manager determined that it was again necessary to institute precautionary

* Period covered, 16 to 24 May 1953.

measures, such as roadblocks and warnings to residents, at various points and times as shown in Incl. 2, Chap. 10, of WT-702(REF.). For this shot these roadblocks were established by personnel of the Las Vegas Field Office. A documentation of the ground monitoring results is given in Incl. 3, Chap. 10, of WT-702(REF.). Infinite dose readings in communities in the fall-out pattern are recorded in Incl. 2. The special attention given to St. George, Utah, resulted in the infinite dose calculations derived from Incl. 3. Extra film badges were exposed in different locations in St. George, Utah. The results are tabulated in Incl. 6, Chap. 10, of WT-702(REF.). Inclosure 18, Chap. 10, of WT-702(REF.) is a report from the Off-Site monitor at St. George.

10.3.3 Significant airborne concentrations (greater than 10^{-4} $\mu c/M^3$) were detected at the communities of Glendale Junction, CP, Alamo, Crystal Springs, Caliente, Pioche, Groom Mine, Lincoln Mine, Bunkerville, and Mesquite. See Incl. 7, Chap. 10, of WT-702(REF.). The average air concentration reported for St. George represents, by a factor of about 5, the highest such level ever encountered in an inhabited area within 200 miles of the Nevada Proving Grounds. However, particle size determinations indicate that the mass median diameter of the airborne material which produced this high concentration at St. George is considerably beyond the respirable range. Therefore, in this instance the operational tolerance level for airborne fission product particles does not appear to have been exceeded. The results of water samples analyzed for fission product activity are shown in Incl. 9, Chap. 10, of WT-702(REF.).

10.3.4 The pictorial presentation of the fall-out pattern is shown in Incl. 4.

10.4 AIR PARTICIPATION

10.4.1 The air space between the 0° and 180° vectors out to a radius of 70 miles and between the 180° and the 360° vector out to a radius of 50 miles was closed at all altitudes from 0430 to 0600 PDT. In addition, the air space bounded by the 70° vector out to radius of 100 miles thence east along the 37° 30 min north latitude meridian to intercept the 112° and 30 min west longitude (due north of Prescott) thence to Prescott, then along the north side of Green 4 and R15 Airways to 37° north and 116° west was closed at 25,000 ft msl and below from 0600 to 1130 PDT. Amber 2 and Red 6 Airways and all air space west was open at 0810 PDT. The air space inclosed by a line joining 37° north and 116° west to Blythe to Douglas to Albuquerque to St. George to 37° north and 116° west was closed at 25,000 ft and above from 0530 to 1330 PDT. The warning area consisted of a circle of 175 mile radius from Las Vegas from 0430 to 1130 PDT.

10.4.2 The two B-29 and one B-25 cloud trackers were off on schedule; however, one of the B-29's had mechanical trouble and aborted the mission early. The data from these aircraft are given in Incl. 10, Chap. 10, of WT-702(REF.). The top of the cloud reached 44,200 ft msl. These data are plotted as shown in Incl. 5. The predicted path of the cloud is shown in Incl. 6.

10.4.3 The helicopter performed a close-in terrain survey and a mission pertaining to a recovery operation. The data for the terrain survey flight are presented as Incl. 13, Chap. 10, of WT-702(REF.).

10.4.4 The L-20 and C-47 performed the terrain survey as in previous shots. The data for the two flights are included as Incls. 14 and 15, Chap. 10, of WT-702(REF.), respectively. The C-47 performed a complete aerial survey of the fall-out area out to a distance of 250 miles on D+1. The data from this flight are given in Incl. 16, Chap. 10, of WT-702(REF.). These aerial data, along with Off-Site ground data, are analyzed and plotted as Incl. 7. Data on the location of livestock in the fall-out path are shown in Incl. 16, Chap. 10, of WT-702(REF.).

10.5 LOGISTICS AND SUPPLY

For the period 16 to 24 May 1953, inclusive, the Supply Section issued 320 protective caps, 924 pairs of shoe covers, 803 pairs of coveralls, 295 respirators, 534 pairs of cotton gloves, 104 pairs of high intensity goggles, 2 pairs of leather gloves, and 150 each bath towels. The laundry serviced 125 protective caps, 832 pairs of shoe covers, 949 pairs of coveralls, 200 respirators, 300 pairs of cotton gloves, and 121 towels. A total of 143 instruments were issued and 51 were repaired. Sixty-four (64) SU-10's were turned in to Reynolds Electric for storage. A total of 2 vehicles were deadlined for radio maintenance, and 41 vehicles were lubricated and received second echelon maintenance.

10.6 GENERAL

10.6.1 The fall-out from this shot covered more area than for any of the previous shots. The 1 r infinity dose line extended to as far as 250 miles from ground zero. The area surrounded by the 1 r infinity dose line was more than 50 miles wide.

10.6.2 Many complaints were received from people in the fall-out area. Complaints ranged from goats turning blue to miners getting radiation sickness. An investigation was made of all the claims, by members of the Test Manager's staff, and none were of such a nature to indicate that they were caused by the fall-out.

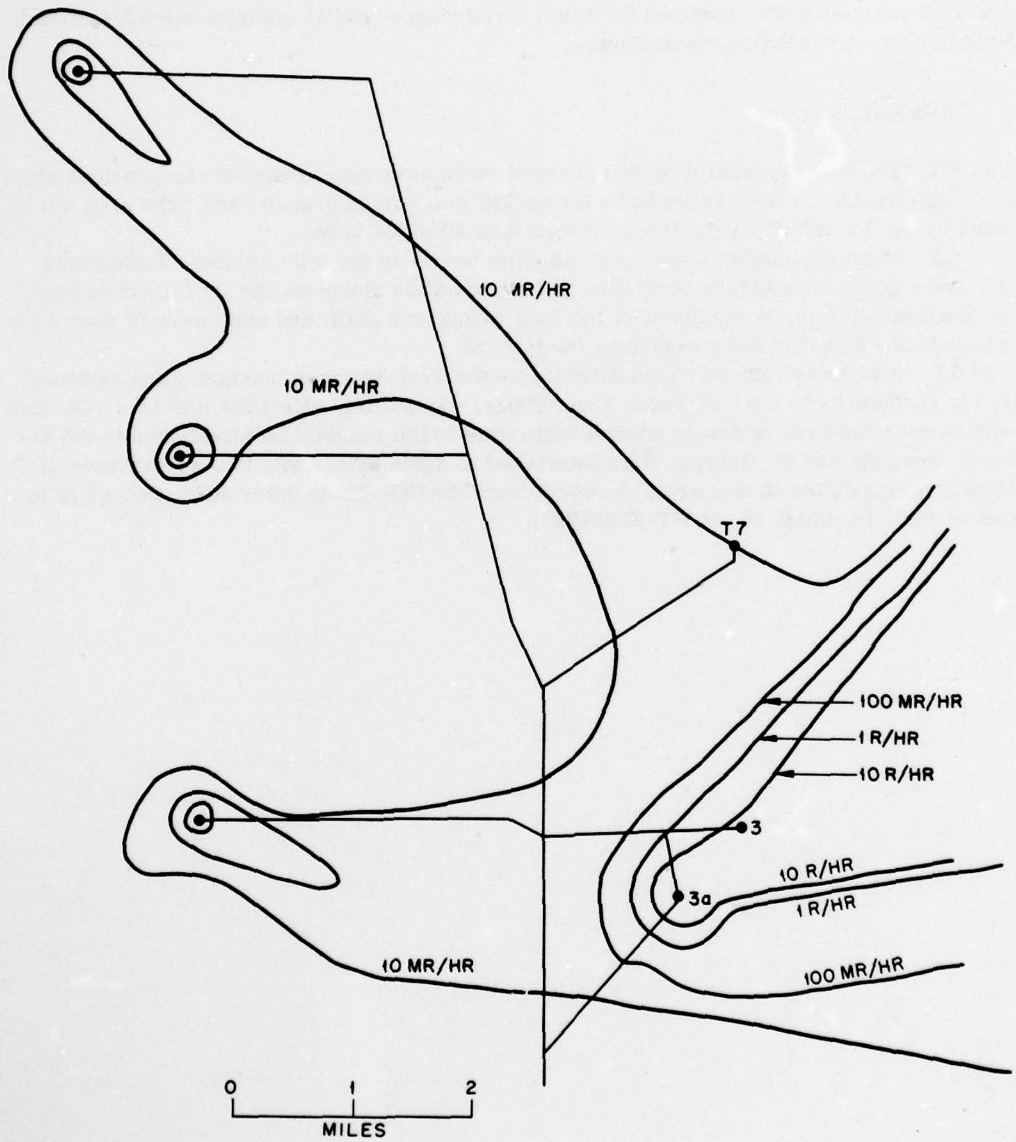
10.6.3 A highway Rad-Safe plan directed by the Test Manager, assigning the responsibility for roadblocks to the Las Vegas Field Office, was put into effect for this shot. Off-Site monitors were required to devote considerable time to the roadblocks established in the vicinity of Mesquite and St. George. This interfered to some extent with the performance of their monitoring duties in this area. A report from the Off-Site monitor at St. George is included as Incl. 18, Chap. 10, of WT-702(REF.).

[redacted]

UNCLASSIFIED

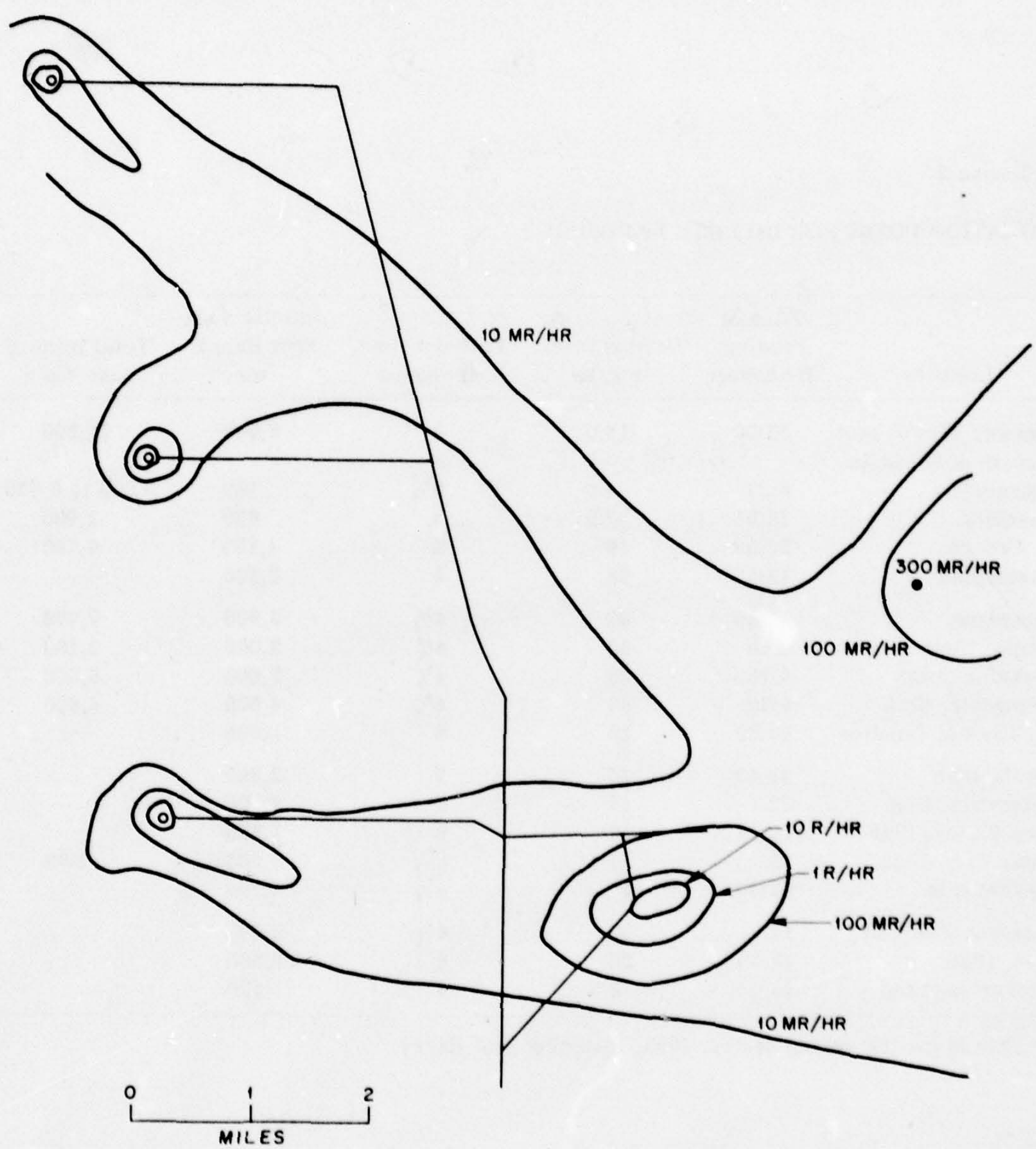
Inclosure 1

YUCCA FLAT RADIOLOGICAL SITUATION, SHOT HARRY



Yucca Flat initial survey, 0600, 19 May 1953 (including 15 May resurvey of Test Areas 1, 2, 4, and 7).

[redacted]



Yucca Flat resurvey, 0700, 20 May 1953 (including 15 May resurvey of Test Areas 1, 2, 4, and 7).

Inclosure 2

RADIATION DOSES FOR INFINITE EXPOSURE

Location	Time of reading, H + hours	Ground level, mr/hr	Fall-out time, H + hours	Infinite dose Shot Harry, mr	Total infinite dose,* mr
Highway 93, hot spot north of Glendale	33:00	18.0	2	5,000	12,500
Bunkerville	6:37	4.8	$2\frac{3}{4}$	180	5,000 to 8,000
Mesquite	38:51	2.0	3	630	1,900
St. George	36:00	16	4	4,200	4,750
Washington	12:50	28	4	2,500	
Hurricane	11:35	80	$4\frac{1}{4}$	5,200	7,700
Virgin, Utah	8:50	42	$4\frac{1}{4}$	2,000	2,100
Rockville, Utah	9:10	80	$4\frac{1}{2}$	3,000	6,000
Springdale, Utah	9:30	80	$4\frac{1}{2}$	4,000	4,600
Mt. Carmel Junction	10:30	26	5	1,600	
Kanab, Utah	28:40	15	5	3,000	
Orderville, Utah	32	14	5	3,000	
Long Valley, Utah	11:18	22	5	1,500	
Cedar City, Utah	12	7	$4\frac{1}{2}$	500	500
Kanarraville	13:40	18	$4\frac{1}{4}$	1,700	
Anderson Junction	14	22	$4\frac{1}{4}$	2,000	
Veyo, Utah	28:30	20	4	3,500	
Enterprise, Utah	29	2.5	4	500	

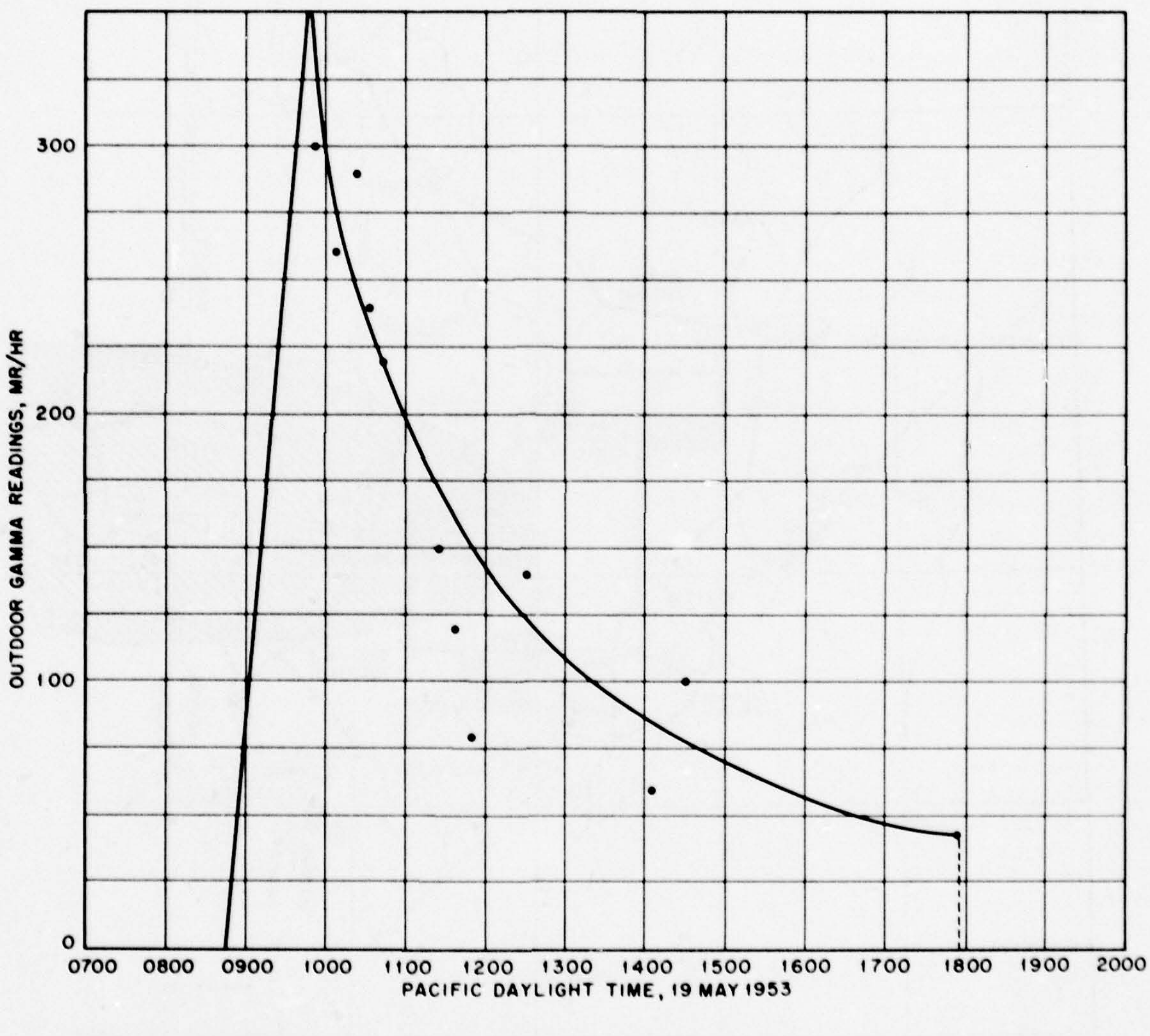
* This is for the Spring Series, 1953, including Shot Harry.

[redacted]

UNCLASSIFIED

Inclosure 3

FALL-OUT AT ST. GEORGE, UTAH, SHOT HARRY, 19 MAY 1953

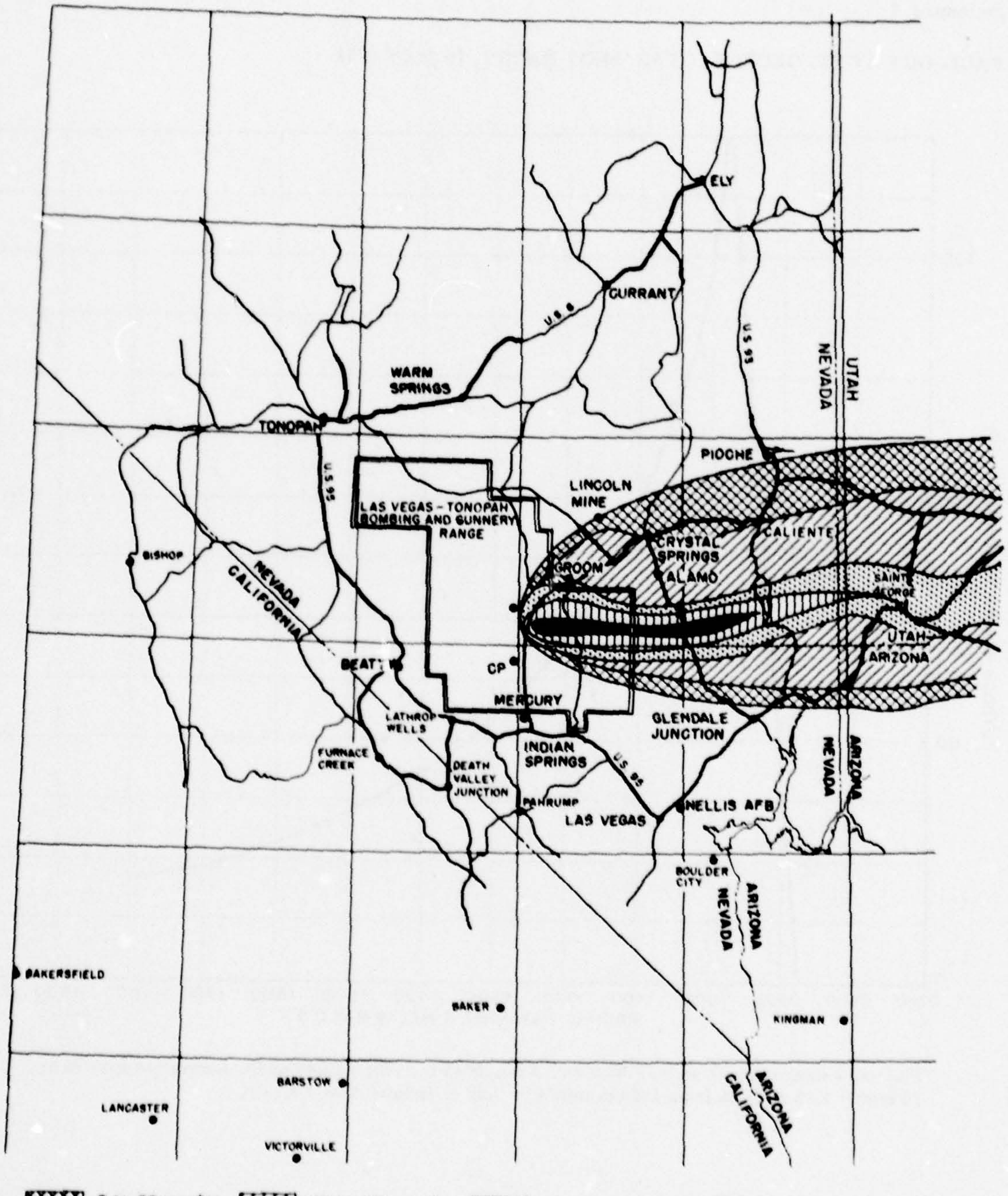


Fall-out calculations. 1 sq in. = 83.3 mr. Area (0845 to 1755) = 13.43 sq in. Equivalent dose (9 hr 10 min) = 1.12 r. Dose from 1755 to infinity = 3.00 r. Infinity dose = 4.12 r.

[redacted]

Inclosure 4

RADIATION INTENSITY AT TIME OF FALL-OUT, SHOT HARRY



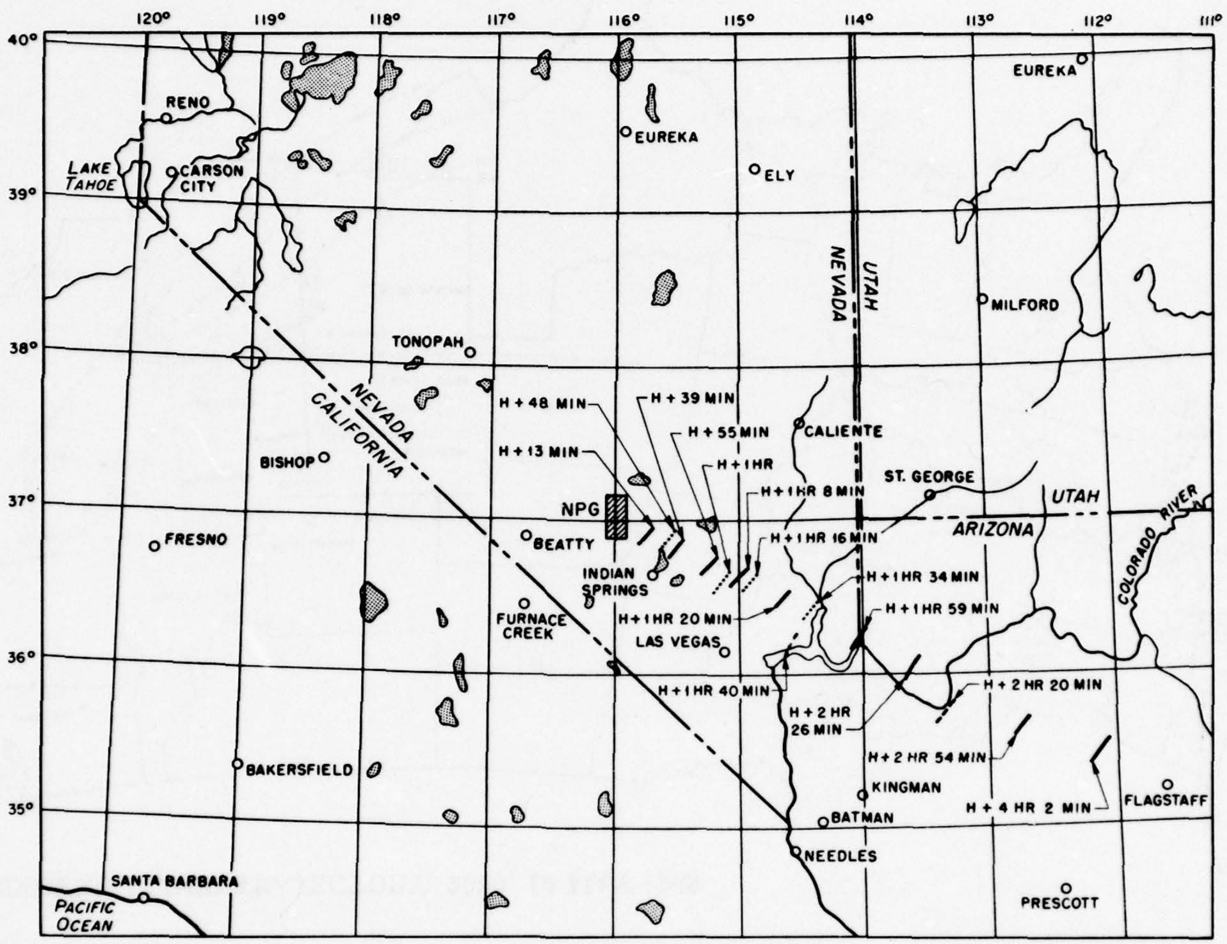
, 2 to 20 mr/hr. , 20 to 200 mr/hr. , 200 to 400 mr/hr. , 400 to 1000 mr/hr. , over 1000 mr/hr. Heavy lines indicate the monitor runs.

[redacted]

UNCLASSIFIED

Inclosure 5

ACTUAL CLOUD TRACK, SHOT HARRY, 19 MAY 1953



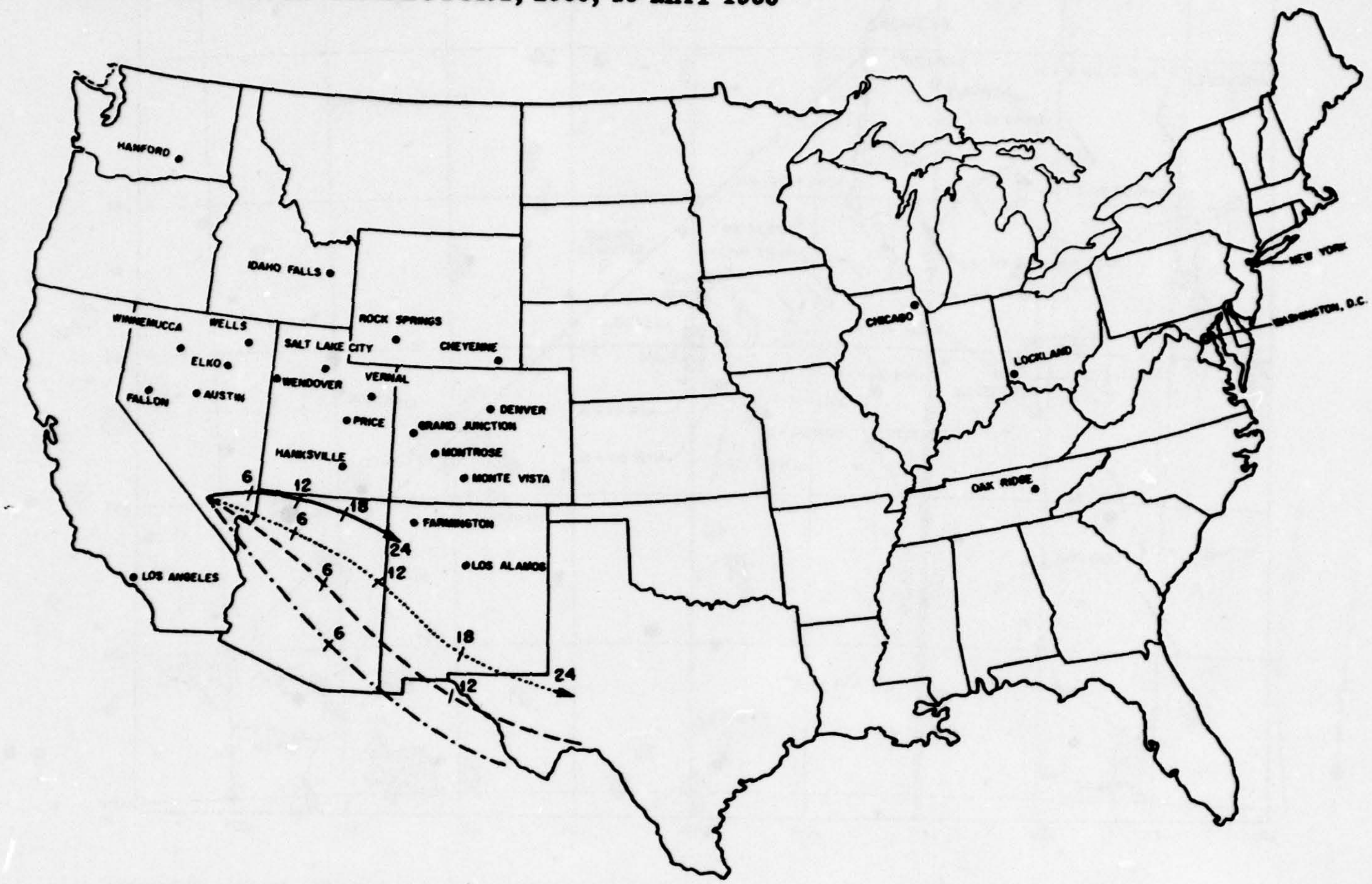
........, 12,000 ft msl. ______, 18,000 ft msl. -------, 22,000 ft msl. Cloud top, 44,200 ft msl.

[redacted]

UNCLASSIFIED

Inclosure 6

PREDICTED CLOUD TRAJECTORY, 2000, 19 MAY 1953



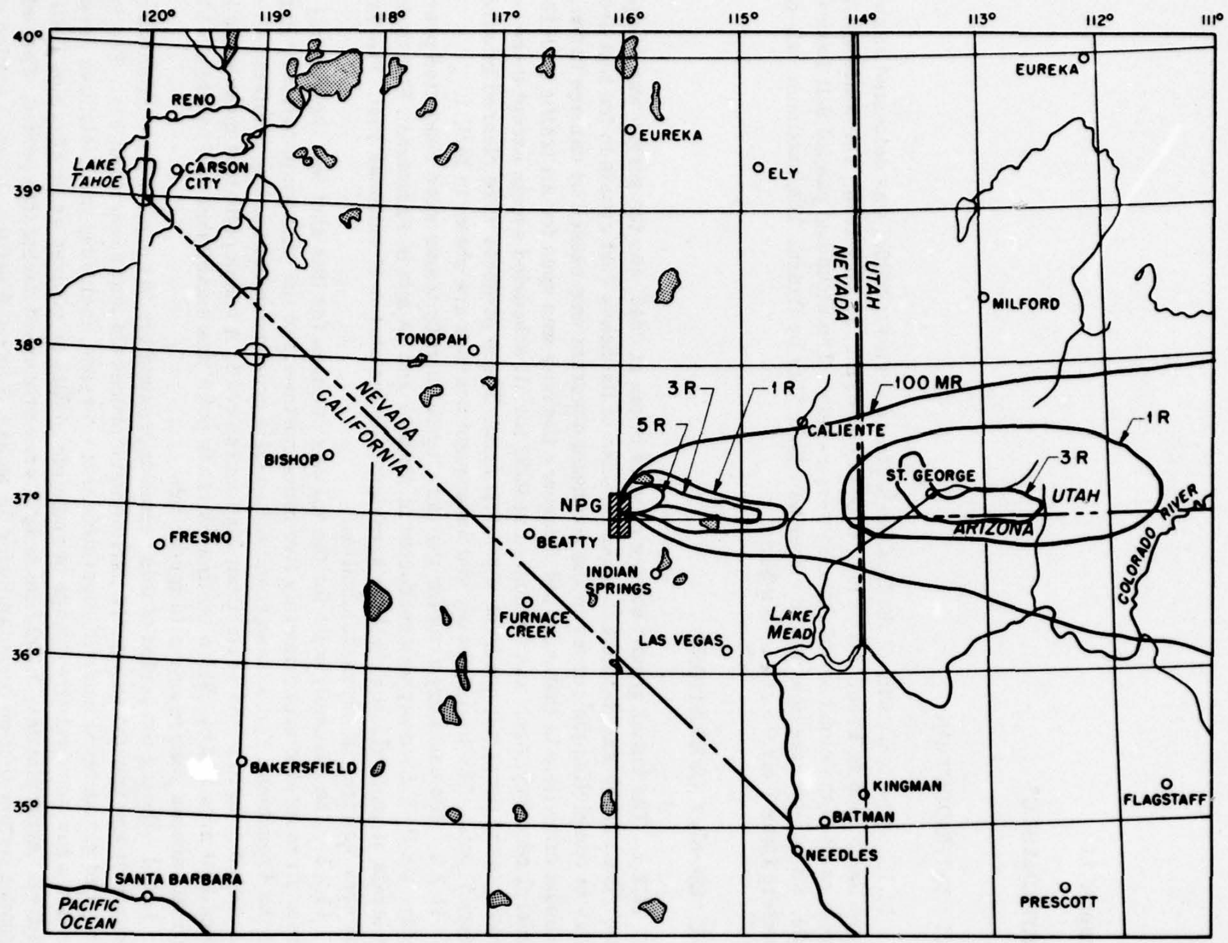
———, 10,000 ft msl. ……., 20,000 ft msl. -------, 30,000 ft msl. -.-.-.-, 40,000 ft msl.

[redacted]

UNCLASSIFIED

Inclosure 7

INFINITE DOSE FALL-OUT PATTERN, SHOT HARRY



Pattern based on combined air and ground survey data. 19 May 1953, Shot Harry.

Chapter 11

SHOT GRABLE*

11.1 INTRODUCTION

11.1.1 The tenth shot of the Upshot-Knothole series, Grable, was detonated at about 500 ft above the ground in Frenchman Flat, NPG, at 0830 PDT, 25 May 1953. The winds at the higher levels carried the cloud out of the area very rapidly. The cloud had passed Salt Lake City by 1200. No fall-out was detected in either Salt Lake City or Ogden. The maximum fall-out encountered was 7 mr/hr at Lincoln Mine.

11.2 ON-SITE OPERATIONS

11.2.1 The initial ground survey reports began at 0846, and the survey was completed by 0940. The survey was difficult to make because of the heavy dust clouds in the test area. Delay in completing the survey in the northeast quadrant was caused by damage to the fence around a mine field in that quadrant. Mercury Highway was open for all traffic at 0915. R (general recovery) hour was announced at 0952 for all scheduled events except those projects located in the northeast quadrant of the test area. Three projects were cleared into the area before R hour. The initial survey and subsequent surveys are shown in Incl. 1.

11.2.2 The usual dry runs for the radiological survey teams were conducted previous to D-day. On D−1 a survey was conducted in Areas 7 and 3A and in Frenchman Flat to determine the levels of contamination in these areas prior to the shot in Frenchman Flat. The Frenchman Flat area was free of any contamination.

11.2.3 The assembly point for the various sections for this shot was the General Observer Area located approximately five miles northwest of the junction of Mercury Highway and the Frenchman Flat access road. A Rad-Safe processing station was established here and was moved at 0910 to the Frenchman Flat access road. A check point was maintained in the Yucca Flat area and by 0930 a continuous check point was established in Frenchman Flat on the main access road near the 10 mr/hr line.

11.2.4 During the period of this report approximately 281 parties were processed into Yucca Flat and approximately 216 parties were processed into Frenchman Flat. The heavy work load encountered made it imperative that everyone, including administrative personnel, who had a low accumulative dosage of radiation to date be utilized as monitors on D-day, D+1, and D+2. Approximately 3,000 film badges were processed during this period. The vehicle decontamination section decontaminated 35 trucks, 3 jeeps, 9 sedans, 1 bus, 1 station wagon, 1 semi-tractor and trailer, and a great deal of equipment used in the test.

---

*Period covered, 25 May to 30 May 1953.

[redacted]

UNCLASSIFIED

11.3 OFF-SITE OPERATIONS

11.3.1 The changes in the anticipated fall-out pattern from Shot Grable are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705).

11.3.2 Minimal fall-out was detected within the 200 mile region with levels only slightly above normal background recorded at Groom Mine, Lincoln Mine, Ely, Currant, Preston, and Lund. Also at various points along highways connecting these communities measurable levels were found. A documentation of the ground monitoring results is given in Incl. 2, Chap. 11, of WT-702(REF.).

11.3.3 In addition to certain communities noted in paragraph 11.3.2, air sampling data indicate that significant, though minor, airborne concentrations were detected at Crystal Springs, Caliente, Panaca, Pioche, and Milford. The air sampling results are presented in Incl. 3, Chap. 11, of WT-702(REF.). The results of water samples analyzed for fission product activity are given in Incl. 5, Chap. 11, of WT-702(REF.).

11.3.4 The pictorial presentation of the fall-out pattern is shown in Incl. 2.

11.4 AIR PARTICIPATION

11.4.1 All air space within a 50 mile radius of ground zero was closed at all altitudes from 0730 to 0900 PDT. The air space inclosed by the 30° and 90° vectors from ground zero out to a radius of 250 miles was closed at 25,000 ft msl and below from 0900 to 1200 PDT. This was changed to the 30° and 60° vectors closed out to a distance of 325 miles, except Airway Red 49 remained open. Another change was made at 1130 PDT which extended the closure time until 1400 PDT. The high level closure was from ground zero to Ely to Fairfield to Fort Bridger to Laramie to Pueblo to Las Vegas to ground zero at 25,000 ft and above from 0830 to 1430 PDT. This was changed to an area bounded by a line from ground zero to Fairfield to Fort Bridger to Cheyenne to ground zero closed until 1200 PDT. At 1140 PDT another change was made in the high level area. At this time the air space above 25,000 ft and bounded by a line from Salt Lake City to Price to Rapid City to Miles City to Salt Lake City was closed from 1200 to 1500 PDT. The warning circle had a radius of 150 miles around Enterprise Radio from 0730 to 1200 PDT. This was changed to a 230 mile radius at 1015. At 1200 all air space west of a line from Price to Salt Lake was opened. Green Airway 3 and all air space south was opened at all altitudes at 1300. Red Airway 1 and all air space south was open at all altitudes at 1330.

11.4.2 The cloud reached a maximum altitude of 34,800 ft msl as reported by sampler aircraft. The cloud tracking B-29's were able to track the cloud at 18,000 and 22,000 ft msl to about 75 miles northwest of Salt Lake City. The low level B-25 tracked the cloud at 12,000 ft. The data from these aircraft are given in Incls. 6, 7, and 8, Chap. 11, of WT-702(REF.). The actual cloud plot is shown as Incl. 3. The predicted path is shown in Incl. 4.

11.4.3 The helicopter made the close-in survey. The data are presented as Incl. 11, Chap. 11, of WT-702(REF.). On a special mission a maximum reading over ground zero at 500 ft was 17 r/hr. This would give a maximum ground reading of approximately 150 r/hr at H+1 hr.

11.4.4 The L-20 was off on its portion of the terrain survey at H+3 hr. The pattern flown and the data obtained are shown as Incl. 12, Chap. 11, of WT-702(REF.). The C-47 was off at H+4 hr. The data for this flight are given as Incl. 13, Chap. 11, of WT-702(REF.). The aircraft did not complete the mission due to severe turbulence. No fall-out was detected, and thus no fall-out plot is included.

11.5 LOGISTICS AND SUPPLY

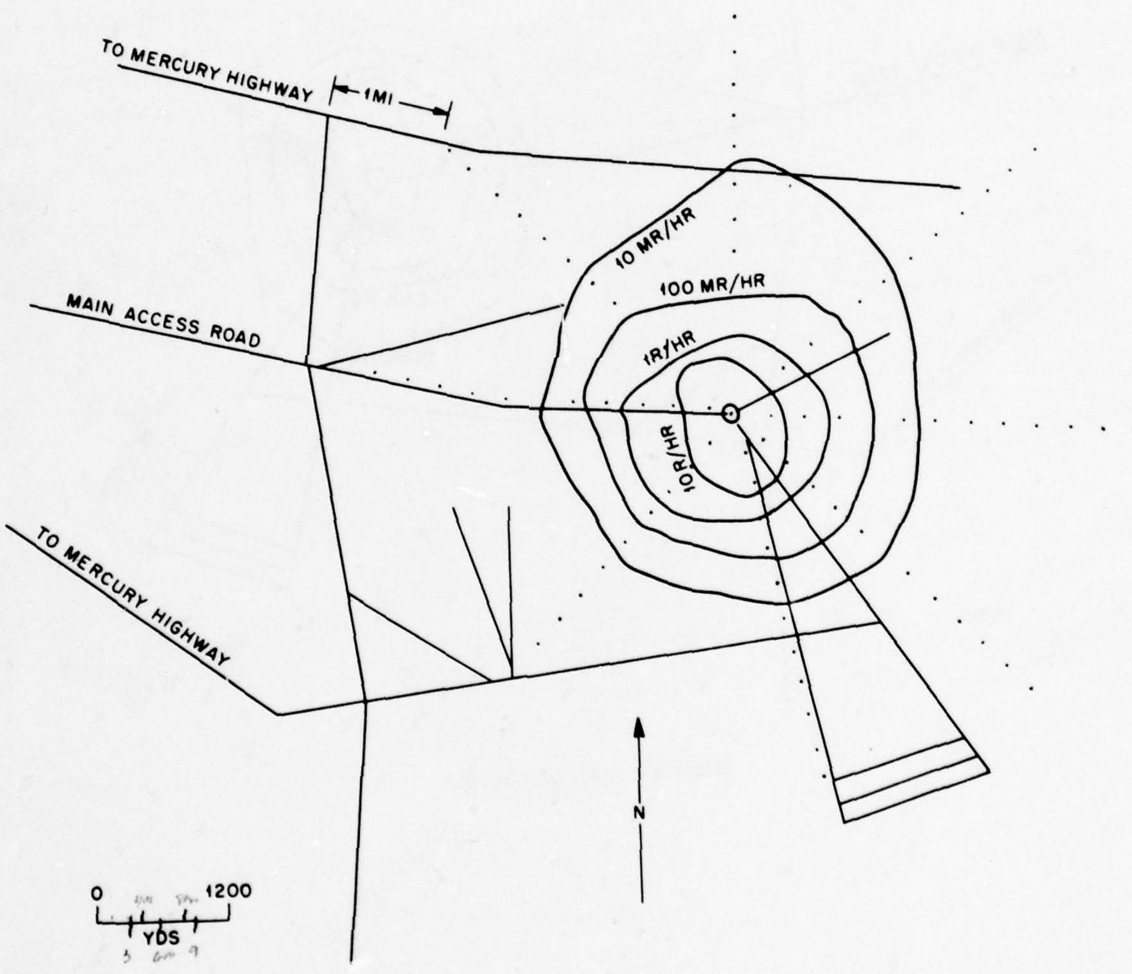
For this period, the Supply Section issued 194 protective caps, 316 pairs of shoe covers, 342 pairs of coveralls, 154 respirators, 310 pairs of cotton gloves, and 16 pairs of clear goggles. The laundry serviced 219 protective caps, 690 pairs of shoe covers, 1,006 pairs of coveralls, 321 respirators, 251 pairs of cotton gloves, and 92 towels. The Supply Section operated a mobile supply point which was located on the main access road to Frenchman Flat in addition to regular supply issue in the Rad-Safe Building. This supply point was in operation until 1700 hr on D+3 and processed an average of 75 sets of protective clothing. A total of 50 instruments were issued, and 15 were repaired. Seventy-three (73) AN/PDR-39's were packed for shipment to Army Signal Laboratory, Fort Monmouth, New Jersey. Weekly maintenance was performed on 25 vehicles, and 8 vehicles were deadlined for ordnance maintenance.

11.6 GENERAL

The radiological problem with this shot was very minor. The highest intensity of fall-out was 7 mr/hr at Lincoln Mine. The cloud passed directly over Salt Lake City; however, no detectable fall-out was found in this area. The On-Site Rad-Safe problem presented a considerable problem in logistics and personnel control. Rad-Safe roadblocks were run down in many instances, and personnel entered the area without Rad-Safe clearances. Processing personnel to enter the contaminated area at both the Rad-Safe Building and at the processing point at the access road to Frenchman Flat made control of the exposure of personnel to radiation complex as it was necessary to telephone cumulative dosage records from the building to the advance processing point.

Inclosure 1

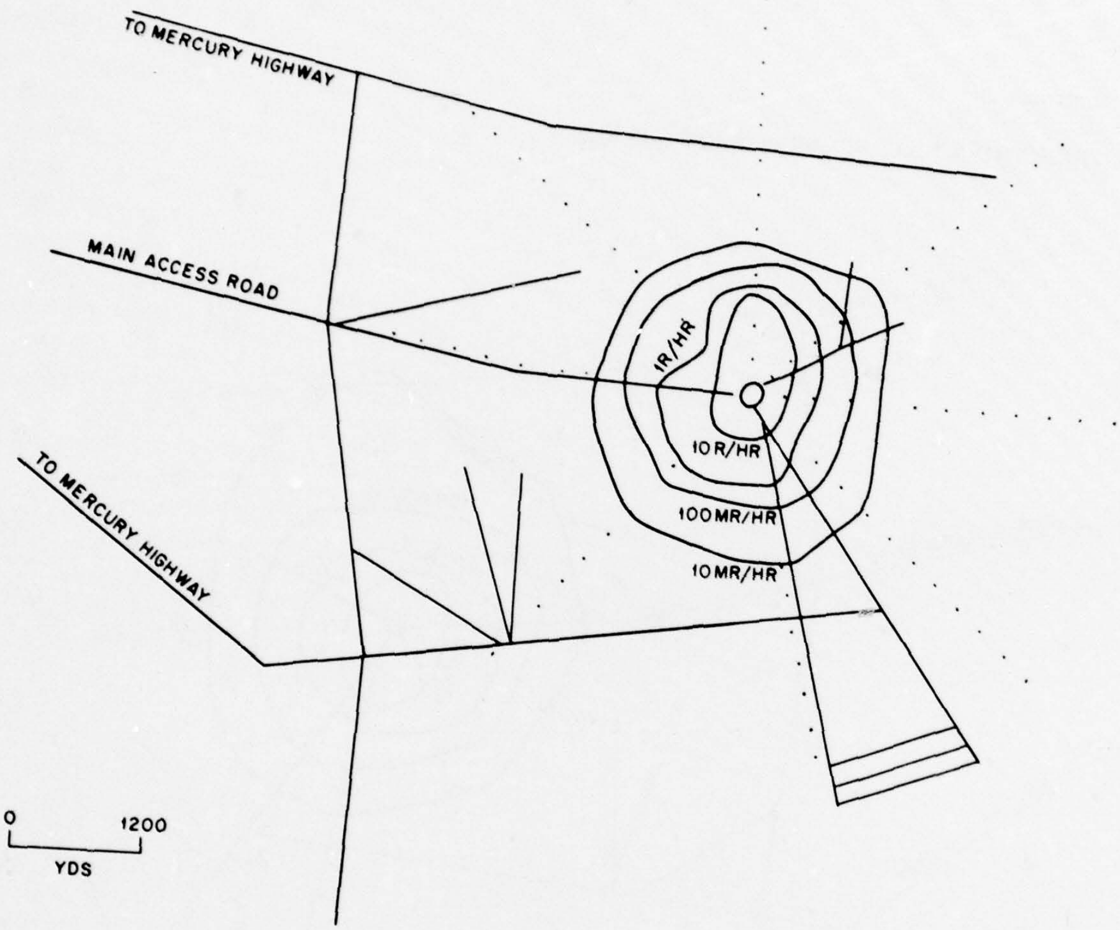
FRENCHMAN FLAT SURVEYS, SHOT GRABLE



Initial Survey, 25 May 1953, R hour, 0950.

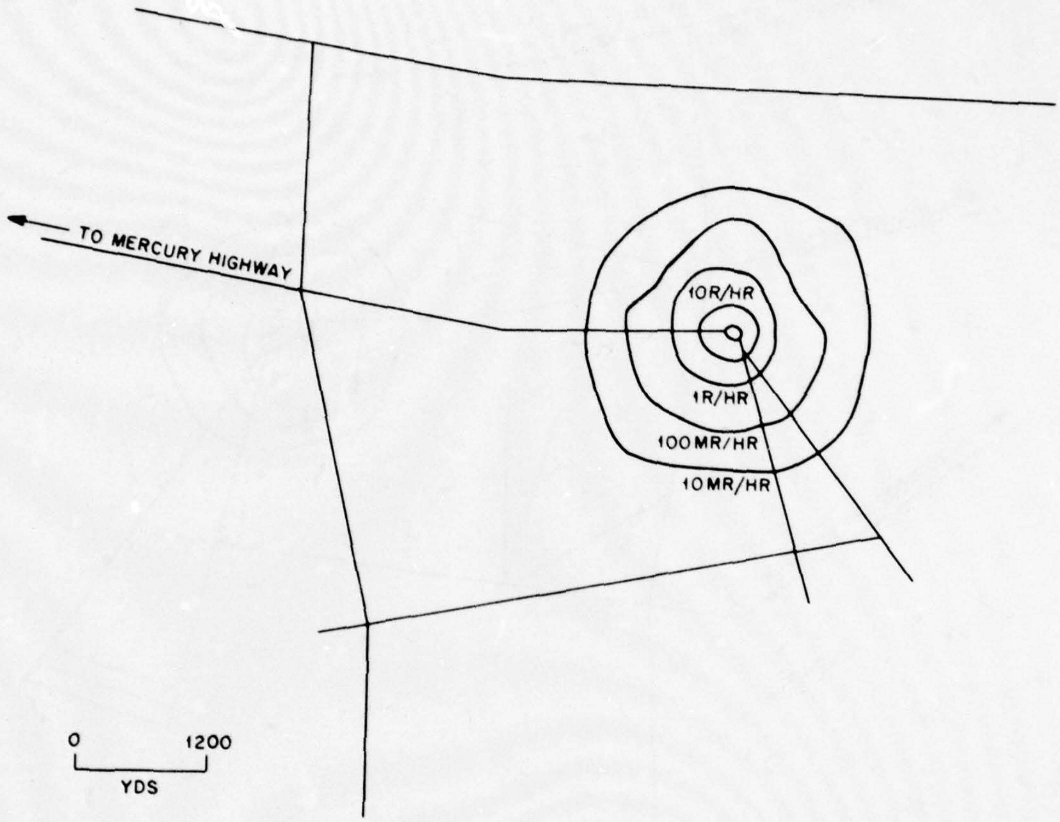
[redacted]

UNCLASSIFIED

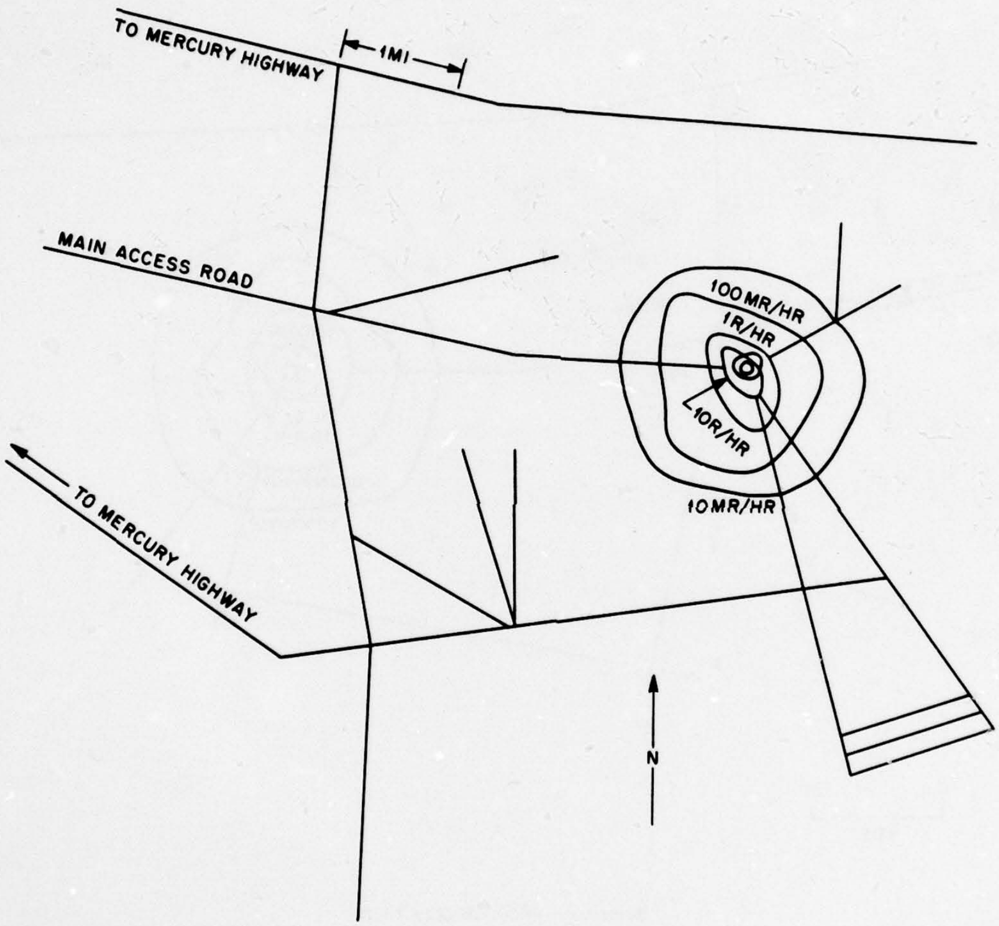


Resurvey, 1630, 25 May 1953.

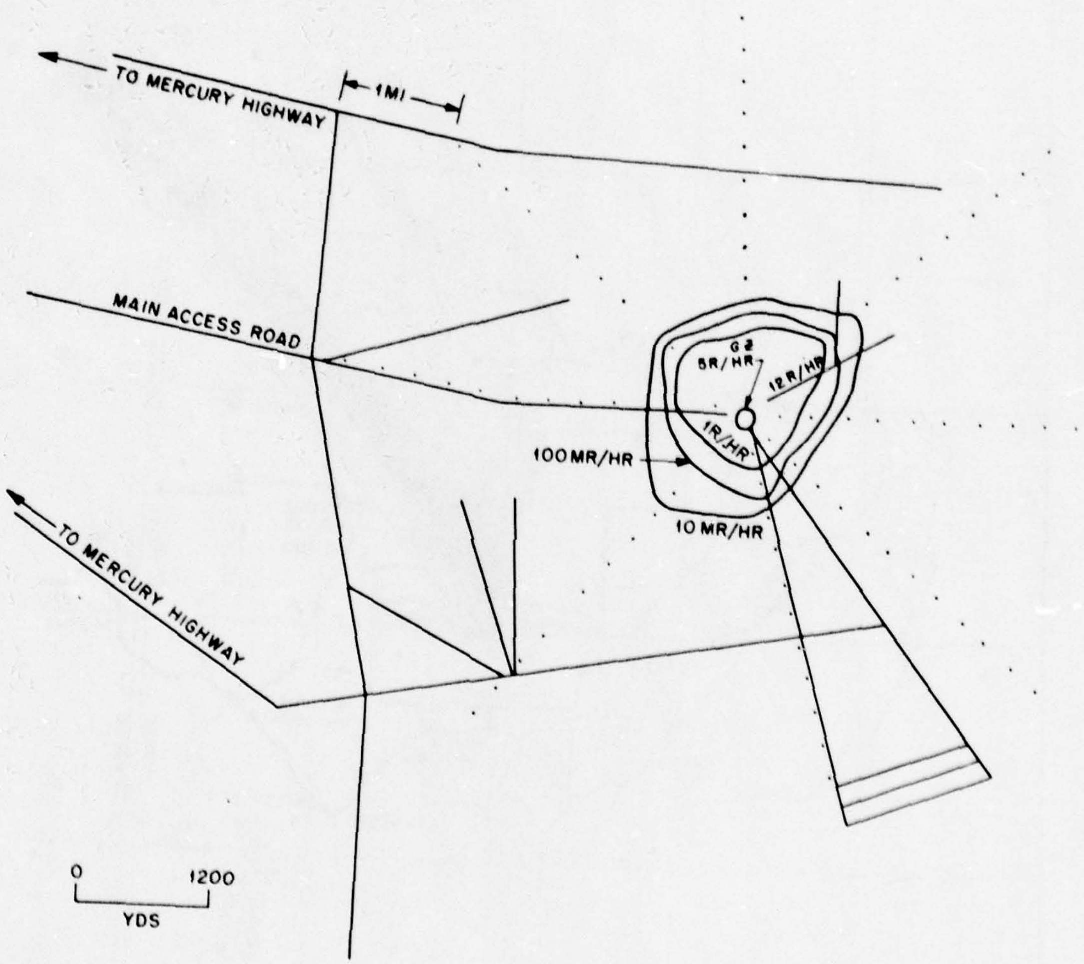
[redacted]



Resurvey, 0630, 26 May 1953.



Resurvey, 1330, 27 May 1953.

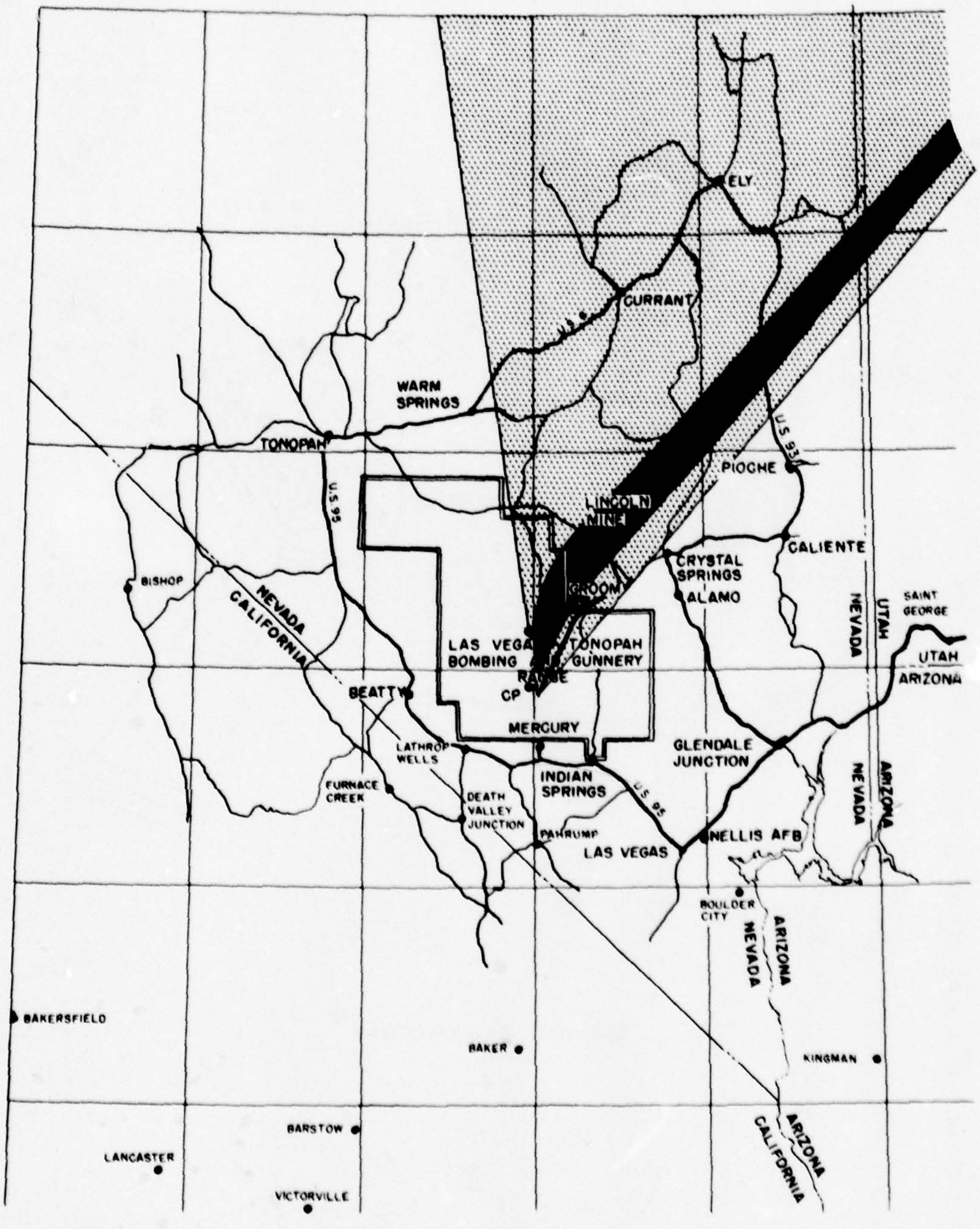


Resurvey, 1100, 28 May 1953.

[redacted]

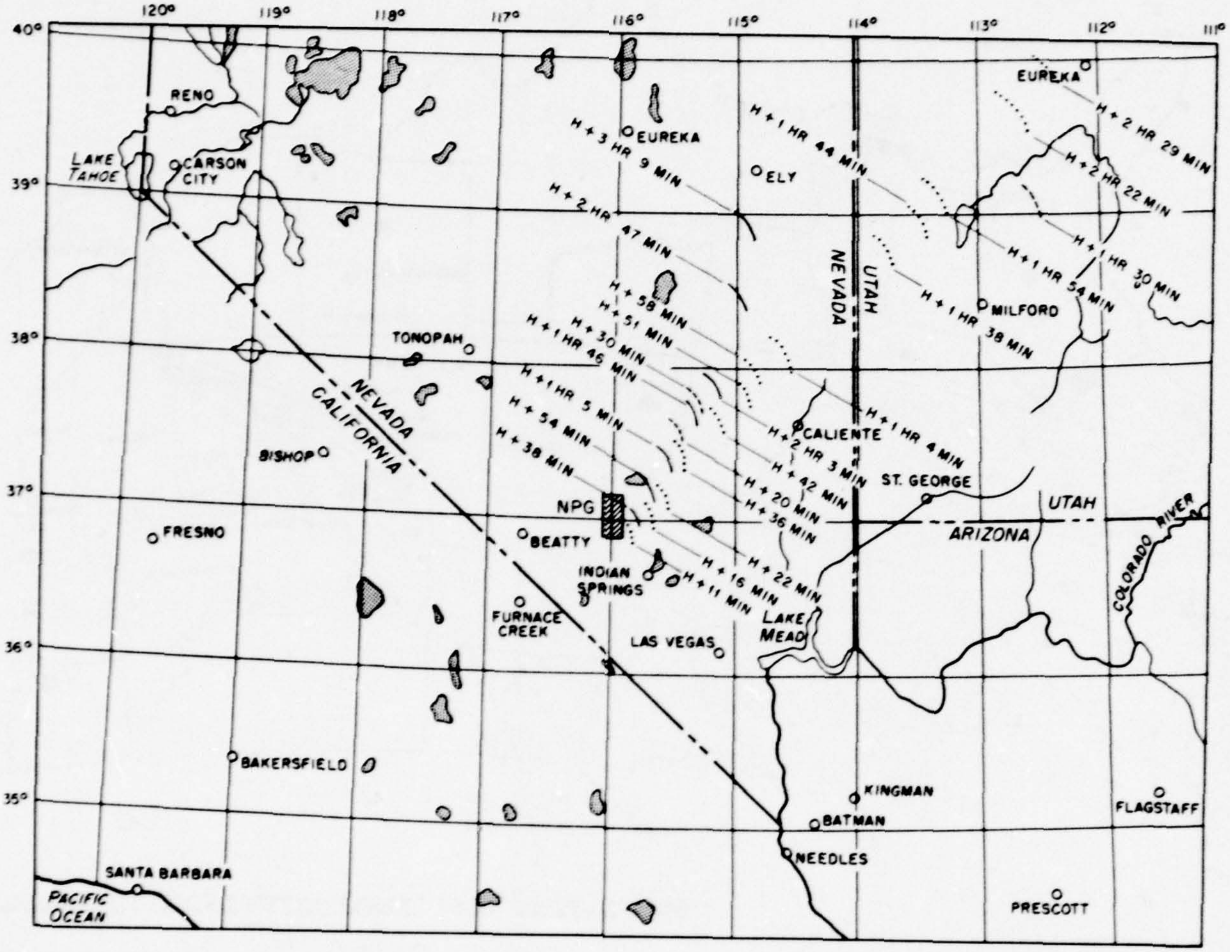
Inclosure 2

RADIATION INTENSITY AT TIME OF FALL-OUT, SHOT GRABLE



■, 2.0 to 20.0 mr/hr. ▒, 0.2 to 2.0 mr/hr. Heavy lines indicate the monitor runs.

ACTUAL CLOUD TRACK, SHOT GRABLE



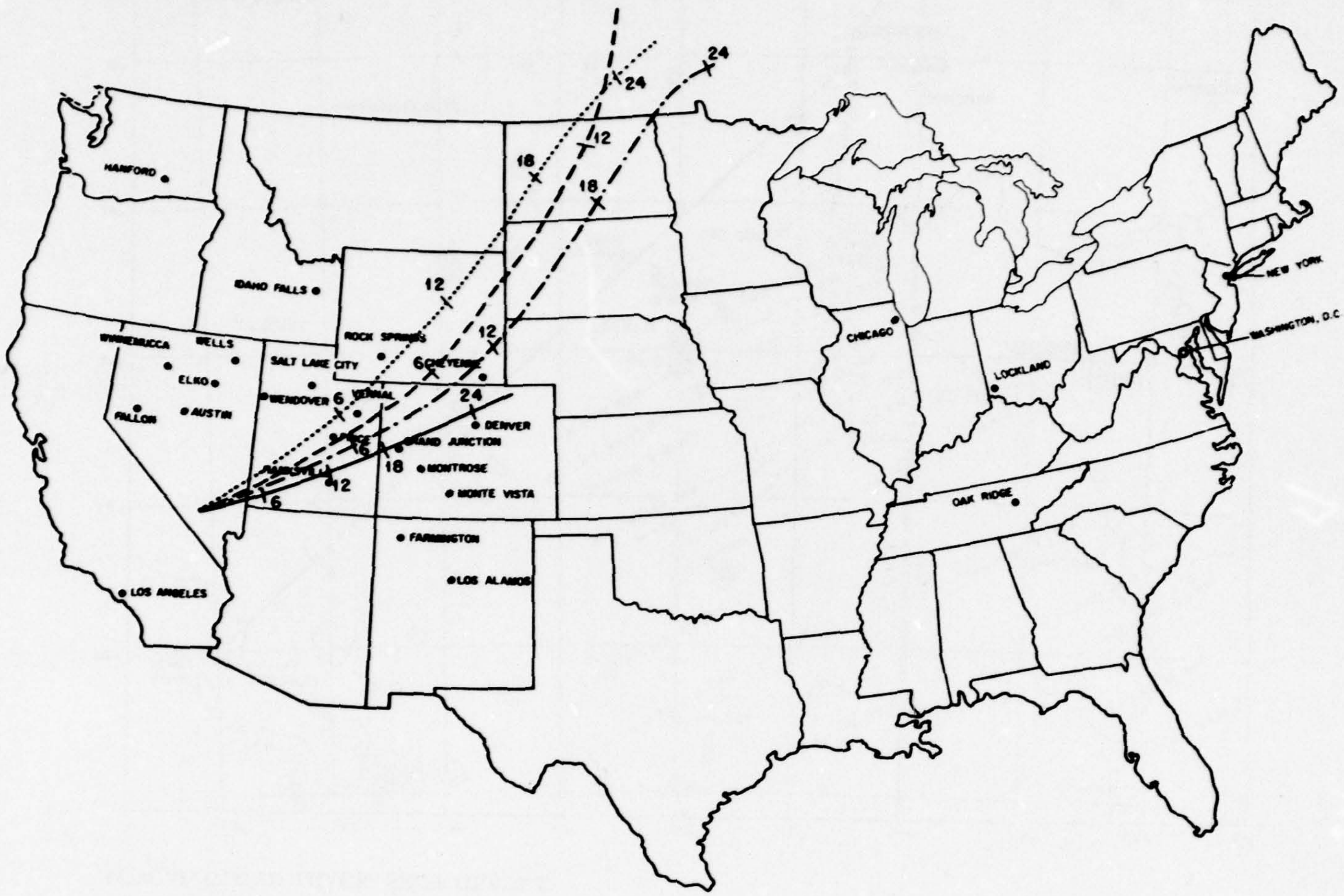
———, 10,000 ft msl. ...., 20,000 ft msl. -------, 40,000 ft msl.

[redacted]

UNCLASSIFIED

Inclosure 4

PREDICTED CLOUD TRAJECTORY, 1900, 24 MAY 1953



———, 10,000 ft msl. ·······, 20,000 ft msl. - - - - - - -, 30,000 ft msl. — - — - —, 40,000 ft msl.

[redacted]

UNCLASSIFIED

Chapter 12

SHOT CLIMAX*

12.1 INTRODUCTION

The eleventh shot of the Upshot-Knothole series, Climax, was detonated at about 1300 ft above the ground in Test Area T-7-3 in Yucca Flat at the Nevada Proving Grounds at 0415 PDT, 4 June 1953, after a three day delay. The winds were light and variable at the time of detonation. The low level cloud spread slowly in the southeast quadrant out to a distance of approximately 75 miles, became scattered, and was dispersed by 1000. Fall-out was light. The maximum ground contamination recorded was 12 mr/hr on Highway 93, ten miles west of Glendale, Nev. The On-Site survey was completed by 0525 and R (general recovery) hour announced at 0532. Mercury Highway was opened to traffic at 0515.

12.2 ON-SITE OPERATIONS

12.2.1 The initial ground survey reports began at 0435, and the survey was completed by 0525. No difficulty was encountered in making the initial survey. The initial survey and subsequent surveys are shown in Incl. 1.

12.2.2 Two dry runs for the initial survey teams were conducted prior to D-day. On D-4 a complete survey of Yucca Flat was made to determine radiation levels before the shot in Test Area T-7-3 (Incl. 2). Surveys were also conducted in the Frenchman Flat area.

12.2.3 One hundred thirty-six (136) parties were processed in Yucca Flat. Approximately 1,230 film badges were processed. Vehicle decontamination processed fourteen (14) vehicles and many items of heavy test equipment.

12.3 OFF-SITE OPERATIONS

12.3.1 The changes in the anticipated fall-out pattern from Shot Climax are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705). The complexities of plotting such a fall-out pattern are well illustrated by the post analysis (Section II, WT-705), which shows the variability in speed and direction of the wind field in the 200 mile region for about the first nine hours following the detonation.

12.3.2 Little fall-out was detected within the 200 mile zone. Levels slightly above normal background were recorded at Glendale Junction, Overton, and vicinity. With the exception of this area, the exact amount of contamination resulting from this shot was masked by that residual occurring from previous detonations. A documentation of the ground monitoring results is given in Incl. 3, Chap. 12, of WT-702(REF.).

---

*Period covered, 31 May to 6 June.

[redacted]

UNCLASSIFIED

12.3.3 In addition to the Overton area noted above, significant airborne activity was detected at the CP, Indian Springs, Alamo, Caliente, Pioche, and Groom Mine, indicating a wide dispersal of the cloud as would be anticipated from the prevailing wind pattern. There was still detectable airborne activity to be found in St. George, Utah, as a result of Shot Harry. The air sampling results are presented in Incl. 4, Chap. 12, of WT-702(REF.). The results of water samples analyzed for fission product activity following this shot are given in Incl. 6, Chap. 12, of WT-702(REF.).

12.3.4 The pictorial presentation of the fall-out pattern is shown in Incl. 3.

12.4 AIR PARTICIPATION

12.4.1 All air space within a 70 mile radius of the Nevada Proving Grounds was closed at all altitudes from 0345 to 0800. The air space above 25,000 ft msl bounded by a line from the Nevada Proving Grounds to Delta, Utah, to Grand Junction, Colo., to Akomita, N. Mex., to Truth or Consequences, N. Mex., to Needles, Ariz., to the Nevada Proving Grounds was closed from 0500 to 1500. At 0630 this notice was modified to read all air space above 25,000 ft msl in the area bounded by a line from Nevada Proving Grounds direct to Prescott, Ariz., to Hanksville, Utah, to Delta, Utah, and back to the Proving Grounds. An aircraft warning circle was declared for all air space within 150 miles of Las Vegas, Nev.

12.4.2 The cloud reached a maximum altitude of 42,700 ft msl as reported by sampler aircraft. The B-29 cloud trackers were able to track the cloud at 18,000 and 22,000 ft msl for a distance of about 100 miles from the Nevada Proving Grounds in the southeast quadrant. Cloud dispersion and low wind velocities made cloud identification and tracking very difficult. The B-25 cloud tracker was able to track the cloud at 12,000 ft msl for a distance of approximately 30 miles southeast of the Nevada Proving Grounds. The data from these aircraft are shown in Incls. 7, 8, and 9, Chap. 12, of WT-702(REF.). The plot of these data is presented as Incl. 4. The predicted cloud track is shown in Incl. 5.

12.4.3 The helicopter was not used in the close-in survey on this shot owing to mechanical difficulties just prior to shot time.

12.4.4 The L-20 departed on its portion of the low level terrain survey at 0715. The data are given as Incl. 12, Chap. 12, of WT-702(REF.). The C-47 was off at 0815. The data for this flight are given in Incl. 13, Chap. 12, of WT-702(REF.). Only insignificant fall-out was indicated, and no fall-out plot is included.

12.5 LOGISTICS AND SUPPLY

For this period, the Supply Section issued 61 protective caps, 93 pairs of shoe covers, 97 coveralls, 53 respirators, 87 pairs of cotton gloves, 1 pair of clear goggles, and 5 pairs of high intensity goggles. The laundry serviced 65 protective caps, 100 pairs of shoe covers, 442 coveralls, 237 respirators, 85 pairs of cotton gloves, and 60 towels.

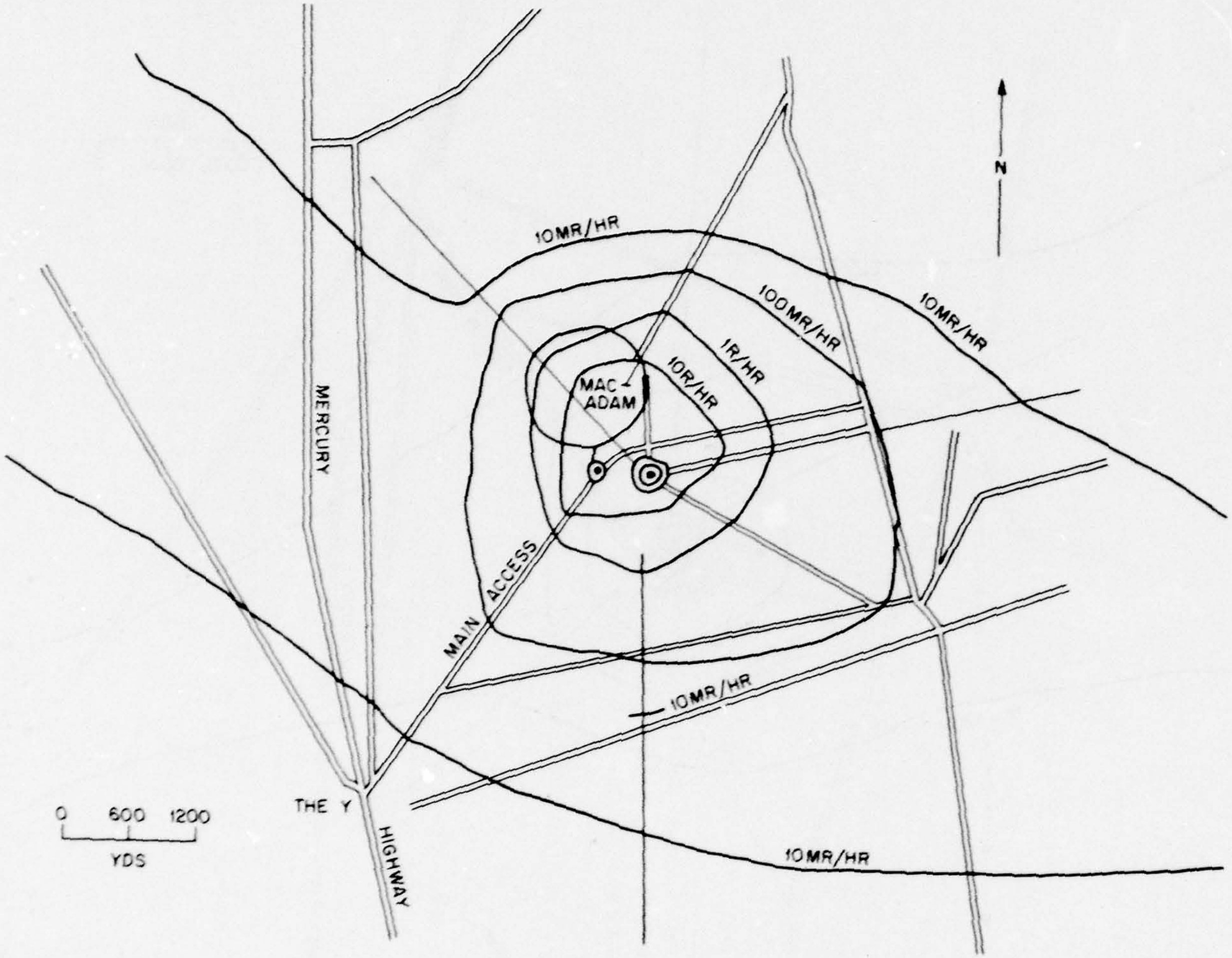
12.6 GENERAL

This shot produced only minor radiological problems. The upper portion of the cloud passed over St. George, Utah; but no radiation levels above background were detected on the surface at this location. As a result of the rapid initial survey and the small number of projects taking part in the test, the On-Site Operations encountered no problems of importance. The extent of residual radioactivity in the test area was somewhat greater than anticipated but did not appreciably affect the data of the Off-Site monitors.

[redacted]

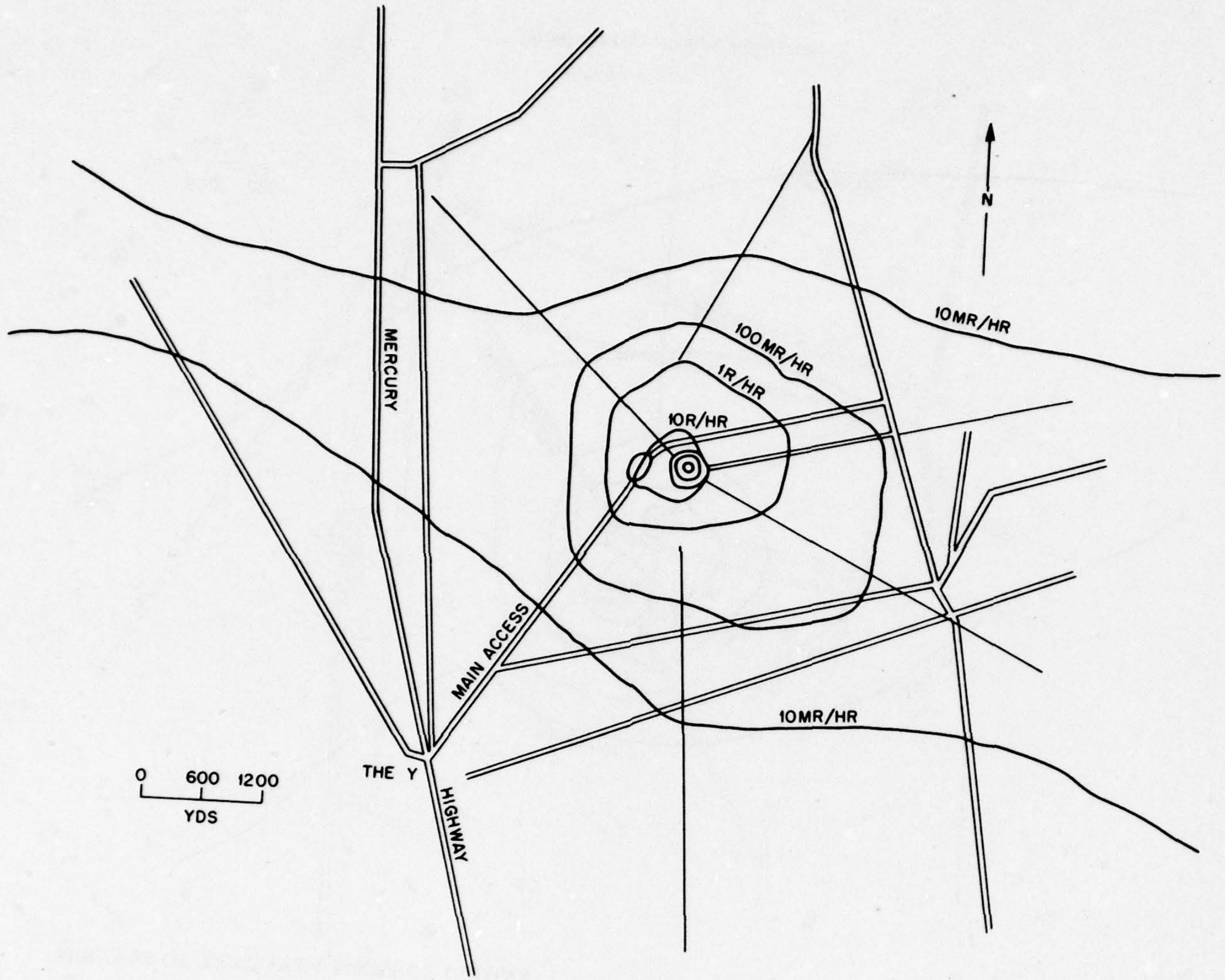
Inclosure 1

SURVEYS OF TEST AREA 7-3, SHOT CLIMAX



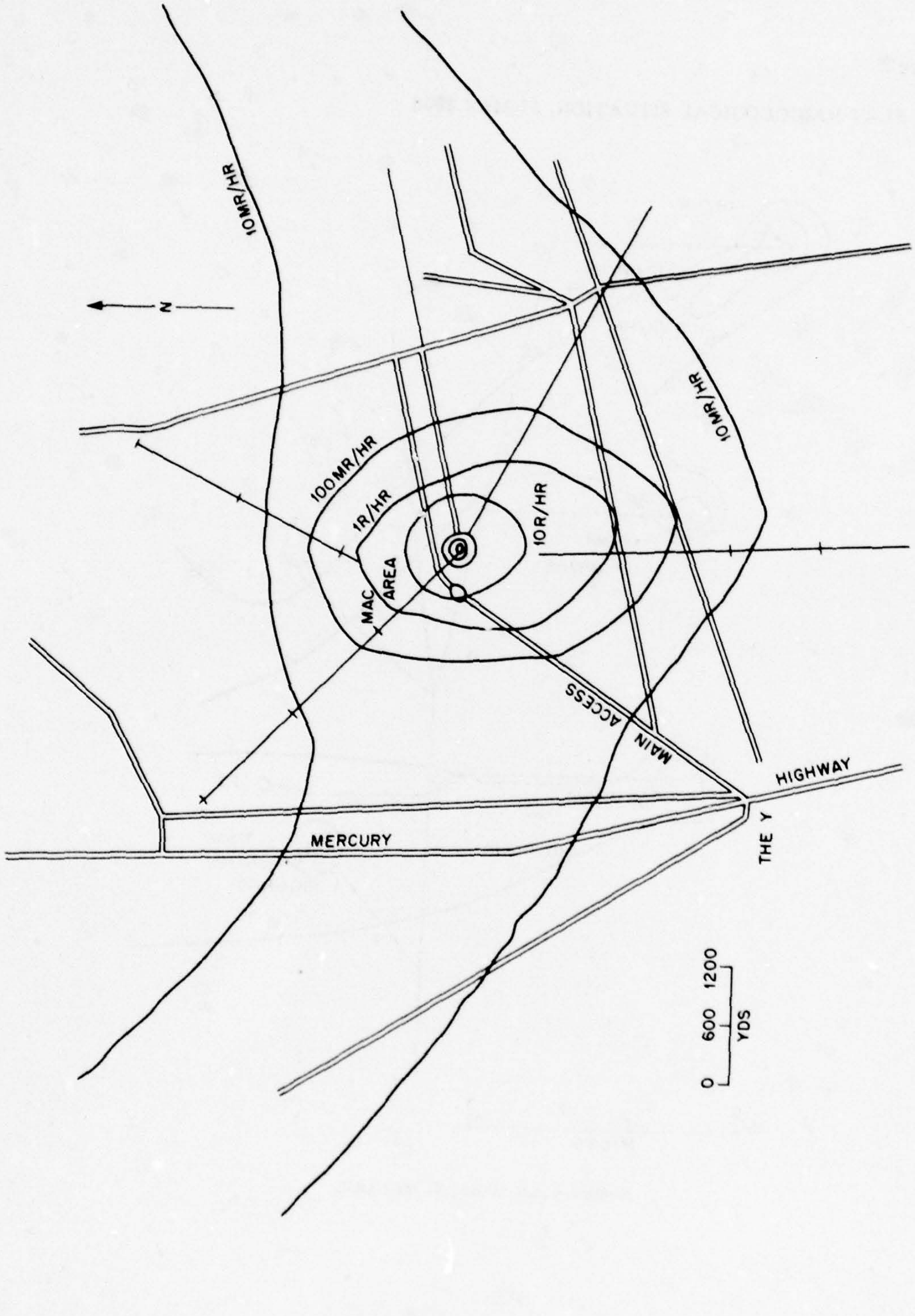
Initial survey, 0500, 4 June 1953.

[redacted]



Resurvey, 0800, 5 June 1953.

[redacted]

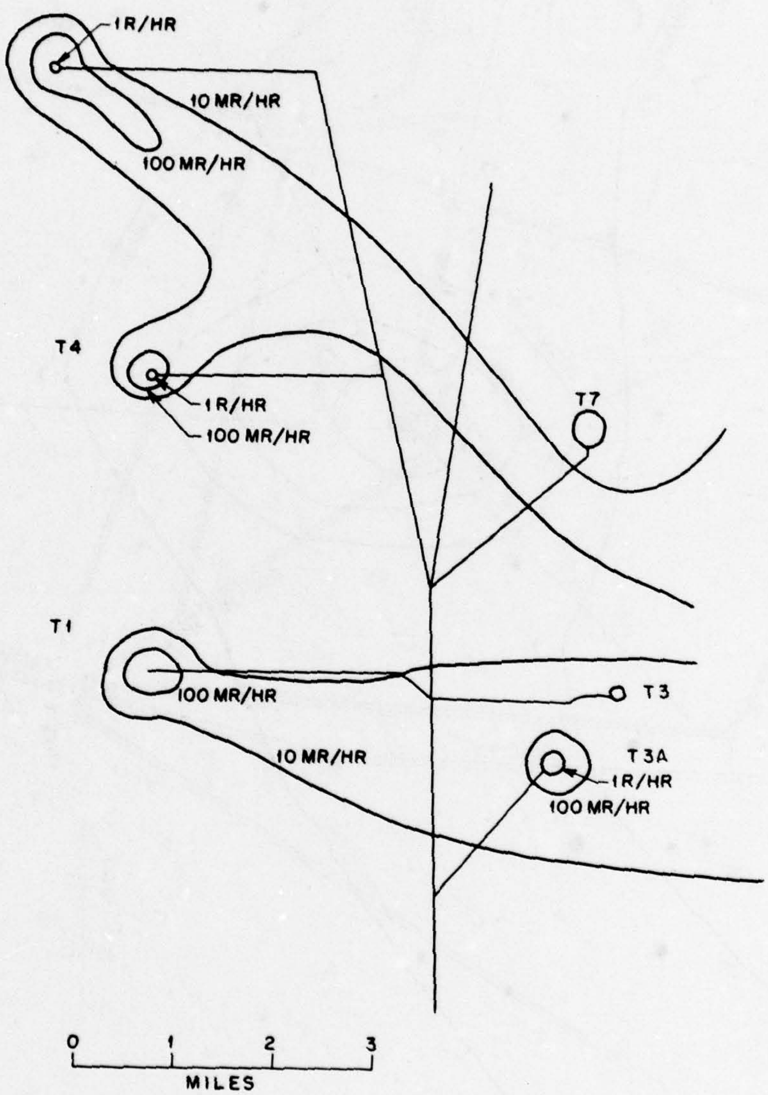


Resurvey, 4 June 1953.

[redacted]

Inclosure 2

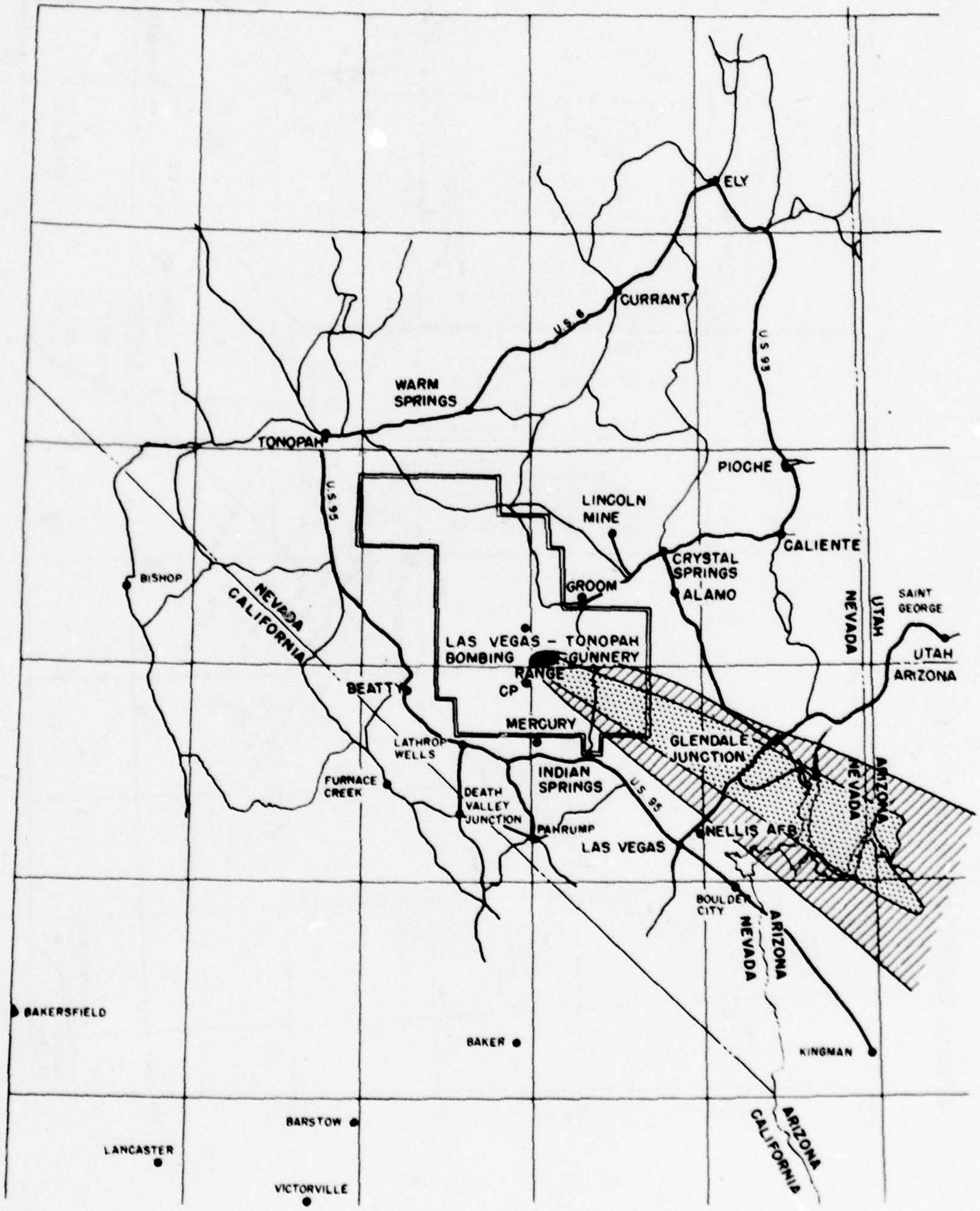
YUCCA FLAT RADIOLOGICAL SITUATION, 31 MAY 1953



Resurvey, all areas, 31 May 1953.

Inclosure 3

RADIATION INTENSITY AT TIME OF FALL-OUT, SHOT CLIMAX



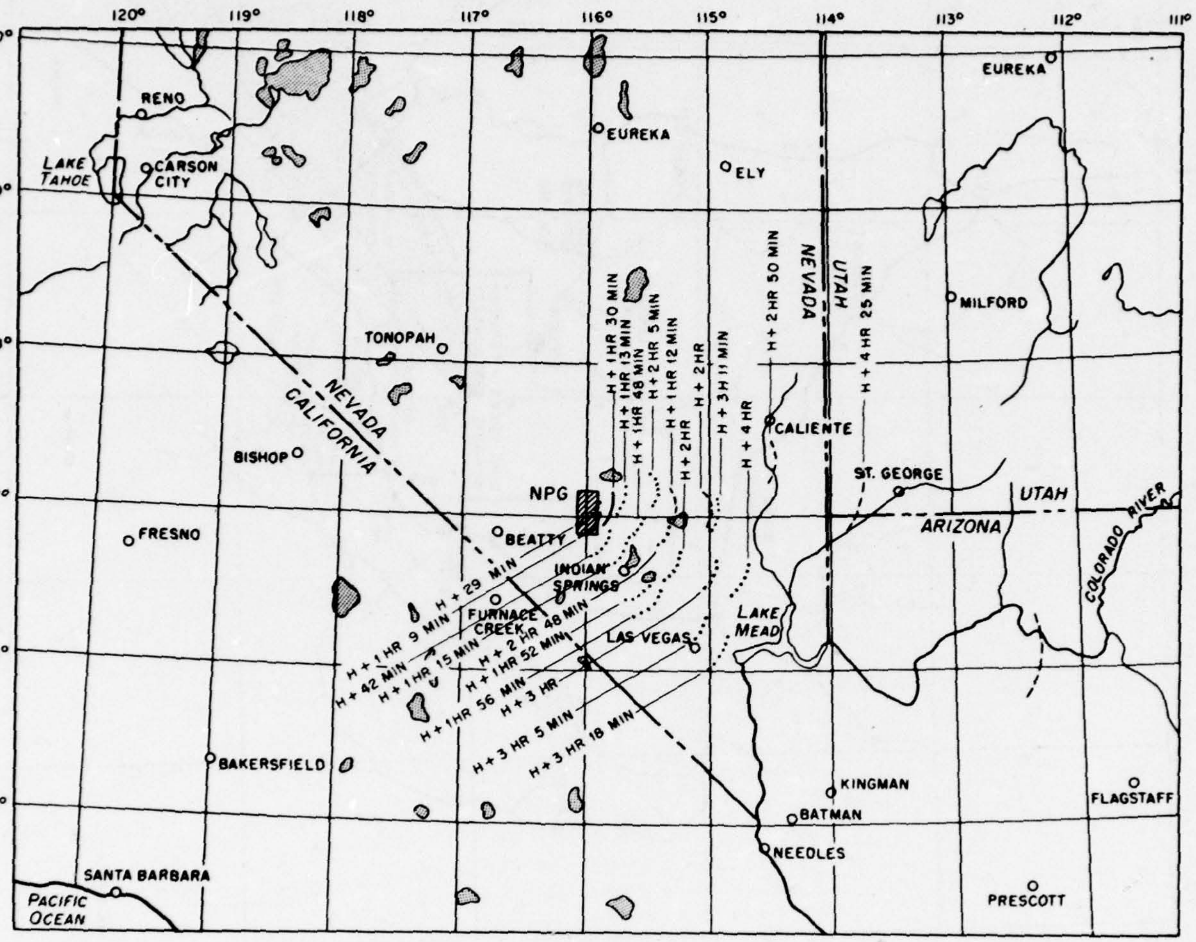
Radiation intensity at time of fall-out: Heavy lines indicate the roads monitored. ▬, 100 mr/hr and up. ▒, 2 to 20 mr/hr. ▨, 0.2 to 2 mr/hr.

[redacted]

UNCLASSIFIED

Inclosure 4

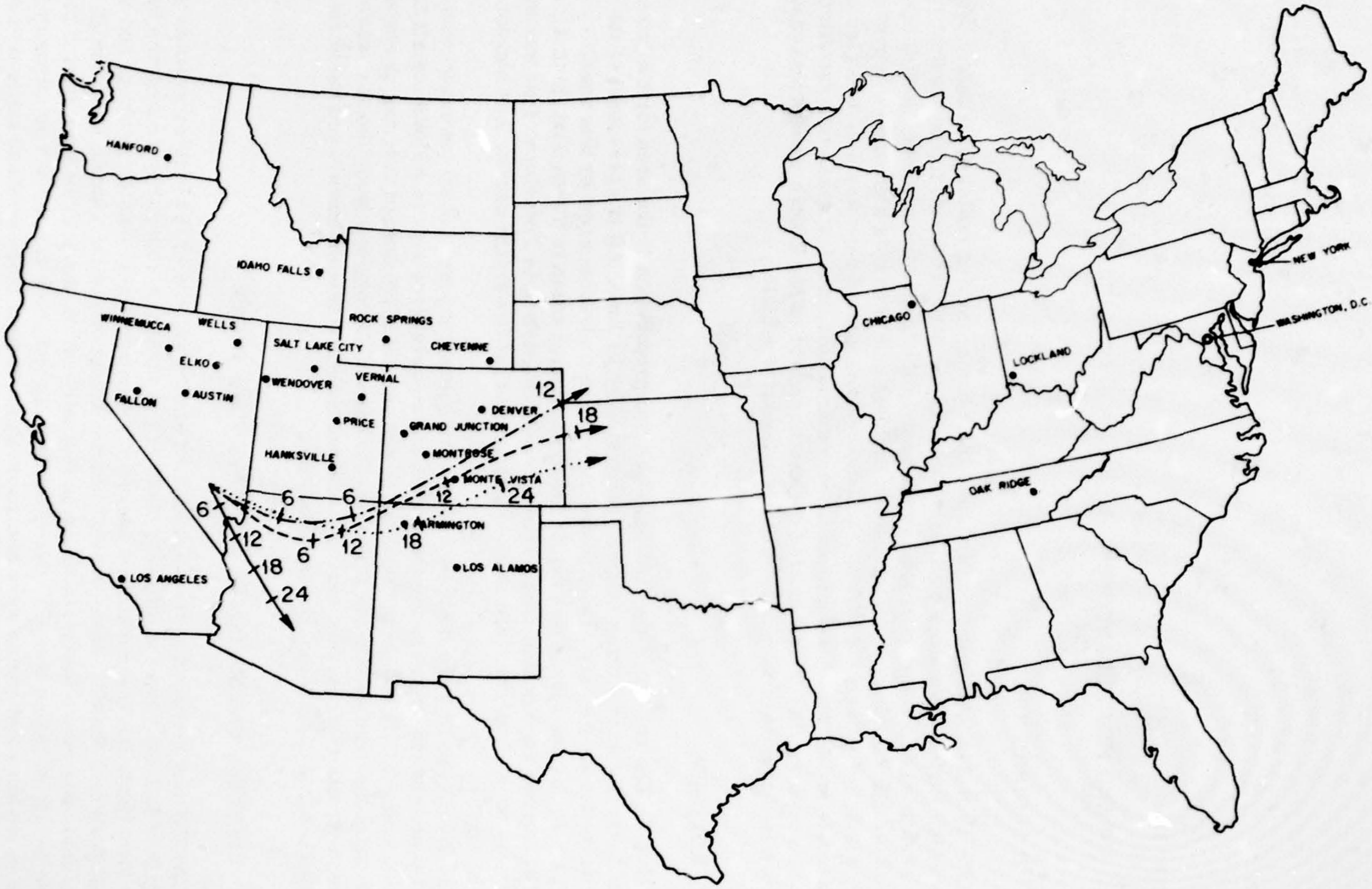
ACTUAL CLOUD TRACK, SHOT CLIMAX



———, 12,000 ft msl. ...., 18,000 ft msl. -------, 35,000 to 40,000 ft msl.

Inclosure 5

PREDICTED CLOUD TRAJECTORY, 0415, 4 JUNE 1953



———, 10,000 ft msl. ...., 20,000 ft msl. -------, 30,000 ft msl. —·—·—, 40,000 ft msl.

[redacted]

UNCLASSIFIED

Chapter 13

ROLL-UP AND MISCELLANEOUS

13.1 INTRODUCTION

The Upshot-Knothole series of atomic tests has presented radiological safety problems which varied from almost nil, in the case of the high air burst, to the greatest problem ever presented at a continental test, in the case of the larger tower shots. Shot Simon is an example of the radiological contamination problem produced by a high yield tower shot. The infinite dose for this shot at 200 miles distance from ground zero was 5 r. Vehicles as far east as Glendale and Mesquite were found to be contaminated, in a few cases to a radiation intensity as high as 500 mr/hr. This required the establishment of roadblocks and decontamination stations in these areas to monitor and decontaminate vehicles.

13.2 ROLL-UP

13.2.1 The roll-up of the Rad-Safe Unit and preparation of the area for the interim period started directly after Climax and was completed by 12 June. All the personnel of the Off-Site Section departed by 9 June. On-Site was reduced to a skeleton crew by this time.

13.2.2 A final survey was run of all contaminated areas in Yucca Flat (Incl. 1), and signs and barricades were posted on all access roads. All debris in Frenchman Flat was monitored, and items over 10 mr/hr were marked and pointed out to salvage crews. The highest reading was 50 mr/hr.

13.2.3 Rosters were made up on the total gamma exposure of all personnel who had entered contaminated areas during the tests. The rosters were sent to AFSWP for all DOD personnel, with the film badges corresponding and accumulative dosage records. A roster of all other personnel was sent to the Director, Division of Biology and Medicine. In addition to the above, separate rosters were sent to individual military establishments and the home offices of agencies that had personnel participating.

13.3 LIFETIME GAMMA DOSES AT POPULATED AREAS

During this operation various small towns in the vicinity of the proving grounds were in the path of fall-out from the different shots in the series. A cumulative record was kept on each town (Incl. 2). The cumulative dosage was computed from outside readings and is based on integration of the $t^{-1.2}$ decay curve, with the exceptions of the Lincoln Mine and St. George, Utah, data which were measured under an intensity curve. As activity from fission products is known to fall off faster than $t^{-1.2}$ due to weathering and other factors and as intensity readings taken in shelters and homes were always much lower than those readings taken outside, it should not be considered that the persons at these locations received the full dosage listed. A figure of one-half or one-third of the reading given would be more nearly correct.

13.4 RECORD OF CATTLE IN THE FALL-OUT AREAS

Throughout the period of the tests, records were made by the Off-Site monitors and monitors in aerial terrain survey planes of the location of cattle they noticed in the fall-out area. This was done because of numerous problems that arose after the Tumbler-Snapper operation regarding cattle. The information is shown in Incl. 3.

13.5 UNUSUAL DOSIMETER-TO-FILM BADGE RATIO

13.5.1 The seventh shot of this series presented a problem in that there were 39 film badge exposures over the 3.9 r limit set by the Test Director. Monitors relied upon their T1B survey meters and pocket dosimeters in controlling their exposure and the exposure of personnel in their parties during surveys and recovery work. Questioning of these personnel and examination of dosimeter records indicated that according to their survey meter readings and pocket dosimeters they should not have been overexposed. Therefore an investigation was made of the incident.

13.5.2 In this investigation the following steps were taken:

1. Film badge processing was reviewed.
2. Film badge readings were reviewed.
3. Calibration curves were run on the 0-10 r dosimeters involved.
4. Statistics were prepared comparing the ratio of pocket dosimeter to film badge readings from previous shots and this shot.
5. Pocket dosimeters and film badges were placed in the field on D + 2 and D + 3 for this shot at the 1 and 2 r lines, and the ratio of the readings was studied.
6. The Project Officer, Project 6.8, was contacted and requested to furnish information on any unusual features he might have noted in the characteristic radiation from this shot.
7. An inquiry was made of the Test Director's Staff to determine if there were any unusual features in this gadget that might cause this.
8. An inquiry was made whether the findings from the chemical analysis of the atomic cloud might indicate a solution to this problem.

Steps 1 and 2 showed that the film badge processing and film badge readings were correct. The recalibration of the 0-10 r pocket dosimeters, step 3, showed that the dosimeters were accurate within their expected tolerance limits.

A review of the statistics gathered, step 4, showed that prior to the seventh shot the pocket dosimeters with few exceptions read generally higher than the film badges. The comparisons of the pocket dosimeter to film badge readings made in the field on D + 2 and D + 3 days showed approximately the same ratio. However, the ratio of the pocket dosimeter to film badge readings on D-day and D + 1 for this shot was consistently lower than 1, and in many cases the film badge read more than twice as much as the dosimeter.

The Project Officer, Project 6.8, pointed out that the beta to gamma ratio was unusually high for this shot and that certain of his instruments indicated a hard beta component and that instruments that respond to low energy gamma radiation indicated higher readings than those indicated by the usual gamma survey meters.

Personnel on the staff of the Test Director indicated that there was nothing unusual in the features of this gadget that would cause a change in the characteristic radiation. This was supported by the chemical analysis.

13.5.3 Examination of the characteristic energy response curves of the pocket dosimeter and the standard film badge indicated that this effect could be caused either by an excess of low gamma energy or by an excess of hard beta. The hard beta would have little effect on the T1B and pocket dosimeter but could cause excessive X rays on the lead shield of the film badge. This would expose the film badge more than normal and cause it to read high.

13.5.4 The information available is not conclusive; however, the information indicates that these high readings are probably the result of a hard beta component in the radiation field the first two days after the seventh shot.

13.5.5 A possible solution for early detection of this condition is the immediate development of film badges worn by the initial survey monitors and a comparison of these readings and their dosimeters. This would have to be done immediately after each shot. This action would not solve the problem but would alert the Rad-Safe organization to the condition existing for that shot.

13.6 DECONTAMINATION SECTION

13.6.1 Much of the work of the vehicle decontamination section was not covered in detail in the narrative report on the various shots. In addition to the decontamination of vehicles and the items listed in the narrative reports in Chaps. 2 through 12, the vehicle decontamination section was called upon to perform numerous difficult and unusual decontaminations. A variety of animals used in the test operation, both dead and alive, were decontaminated during the operation prior to their turn-over to project personnel. Live animals were usually vacuumed and dusted. Dead animals were often washed with soap and water until readings were brought down to tolerable levels. After Shot Grable, 50 dead dogs were decontaminated. A great many items of USMC Petroleum Oil Lubricant equipment, with readings often as high as 20 r/hr, were decontaminated to acceptable levels. Three Navy LVT's that were to be shipped from the Proving Grounds by contract carrier were worked on for a period of approximately four days so they could meet the contracted shipment date. This later work was done at the temporary station set up in the Frenchman Flat area.

13.6.2 Other unusual decontamination activities included decontamination on the inside of tower cabs, which had been contaminated by prior shots, in Areas 3A and 2 in the Yucca Flat area. Throughout the test period, large quantities of scientific measuring devices and construction equipment were decontaminated. Electrical equipment and cameras presented a major problem as it was not possible to use steam and water on much of this equipment.

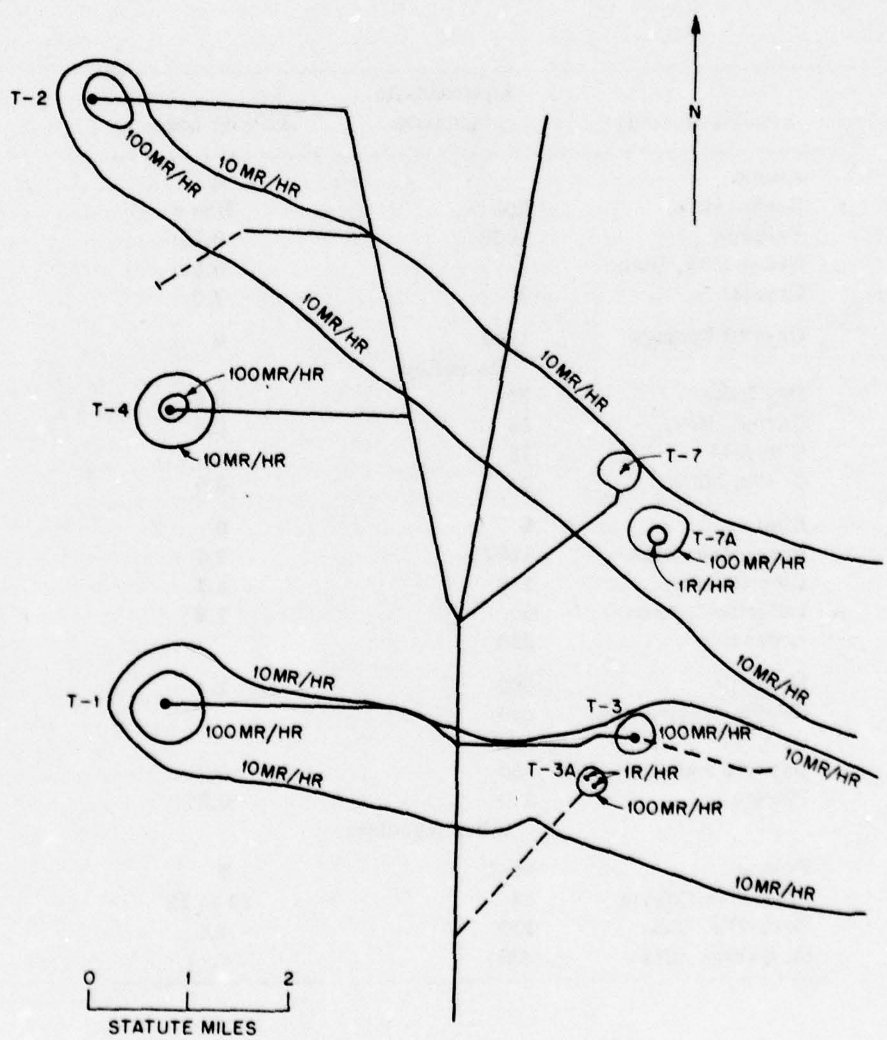
13.6.3 During Shot 8 and Shot 10 in the Frenchman Flat area, a decontamination station was set up which operated continuously for three days. During the period between Shot 6 and Shot 11, the vehicle check point at the intersection of the access road to the CP and Mercury Highway operated continuously. Lights were installed by the AEC for night work.

13.6.4 A routine check was made after each shot of vehicles parked in the Mercury motor pools. Throughout the test series only four vehicles were found to be contaminated over the tolerance limit. It was assumed that these vehicles had evaded the vehicle monitor check point.

13.6.5 Levels of contamination reached in the vicinity of the decontamination station could always be brought down to tolerance and did not present excessive exposures for the men.

Inclosure 1

YUCCA FLAT RADIOLOGICAL SITUATION, 8 JUNE 1953



[redacted]

Inclosure 2

CUMULATIVE FALL-OUT RECORD

Population center	Approximate population	Infinite dose, r
Alamo		0
Bunkerville	202	5 to 8
Caliente	1000	0.15
Cedar City, Utah		0.5
Crystal	7	7.0
Crystal Springs	1200 (in valley)	0
Dry Lake	>35	0.6
Garnet, Nev.	16	0.2
Glendale	15	
Groom Mine	3	0.6
Hiko	6	0
Hurricane, Utah	1500	7.7
Lincoln Mine	270	3.5
Littlefield, Ariz.	50	1.8
Logandale	350	
Mesquite	600	2.1
Moapa Reservation	250	
Overton	600	
Overton Landing	150	0.01
Panaca	300 (plus schools)	0.25
Pioche	2000	0
Riverside Cabins	14	12 to 15
Rockville, Utah	300	6.0
St. George, Utah	5000	4.75

[redacted]

Inclosure 3

CATTLE IN FALL-OUT AREA

The following table has information on cattle noted by the monitors in the terrain survey aircraft. Infinite dose readings are based on readings taken from the aircraft in the vicinity of the cattle and should be considered as only approximate; and, as the cattle migrate from area to area, the readings should not be considered as the dosage received by the cattle. All bearings are from a point at 37°N 116°W, or the approximate center of the Proving Grounds.

Position	Time	No. of cattle	Infinite dose, mr
		25 April 53	
152 miles at 106°	1245	50	5000
107 miles on a bearing of 120°	1130	8	3700
122 miles on a bearing of 117°	1145	8	4000
78 miles on a bearing of 125°	1245	30	5000
149 miles on a bearing of 135°	1006	60	500
		24 March 53	
57.5 miles at 54°	0842	50	Background
51 miles at 64°	0842	15	Background
36 miles at 337°	0916	40	60
48.5 miles at 23°	0946	20	50
77.5 miles at 55°	1032	6 horses and 200 cows	Background
56.5 miles at 360°	1058	50	240
76.5 miles at 28°	1231	20	Background
67.5 miles at 8°	1243	6	1250
		19 May 53	
18 miles at 24°	0850	50	4500

[redacted]

UNCLASSIFIED

The following table has information on cattle noted by the ground monitors. The infinite dose is based on intensity readings taken by the monitor in the area.

Date	Location	No. of cattle	Infinite dose, mr
24 March 53	Adaven-Sunnyside region	1500 to 2000 sheep	1000
18 April 53	Valley of Fire	150 cattle	3000 to 6000
25 April 53	Virgin River Valley	550 cattle	1500 to 6000
16 May 53	St. George and vicinity	7 herds of milk cows	3000 to 6000

[redacted]

UNCLASSIFIED

Chapter 14

COMMENTS ON ORGANIZATION AND PERSONNEL

14.1 INTRODUCTION

The operational peculiarities confronted with each shot and the data obtained are included in the preceding chapters. This chapter contains comments on the general organization, changes to the organization, and a brief account on the functioning of each section in the Rad-Safe Unit, including the idea of a permanent Rad-Safe Support Unit for atomic tests.

14.2 ORGANIZATION

A reorganization of the Rad-Safe Unit was effected after the second shot, with the departure of the executive officer of the Support Unit who had been the On-Site Operations Officer, by appointing the Commanding Officer of the Rad-Safe Support Unit as On-Site Operations Officer. The Rad-Safe Officer and the Rad-Safe Control Officer assumed the responsibility for operational administration of the Rad-Safe Unit and consolidation of the journal for the Rad-Safe Unit Report. This centralized the operational control of the Rad-Safe Unit and put the Commanding Officer of the Rad-Safe Support Unit in a direct supervisory position with respect to the greater portion of his personnel. This reorganization resulted in the organization shown in Incl. 1. No major changes were made in the organization of the On-Site, Off-Site, Logistics and Supply, or Control sections with the exception that the helicopter used in the initial survey was taken from On-Site and placed under the Control Officer.

14.3 ON-SITE OPERATIONS

14.3.1 As covered in the first chapter, the 9778th TSU Rad-Safe Support Unit provided the bulk of the personnel for the Rad-Safe Unit, and in particular the On-Site Operations Section. During the greater part of the operation, the Commanding Officer of the Support Unit was also On-Site Operations Officer.

14.3.2 Owing to the length of this operation, it was necessary to rotate personnel from the various sections of the Rad-Safe Unit so as to prevent accumulation of excess dosages by the personnel of the monitoring section. This rotation of personnel, plus the arrival of new personnel, necessitated a continuous training program in monitoring techniques. This refresher program for monitors was conducted by the On-Site Section and included training in communication procedure.

14.3.3 With the addition of the eleventh shot, it was found necessary to request the Test Director to authorize an increase in the 3.9 r tolerance dosage for 22 monitors in the section to 4.5 r as a total dosage for the operation and the roll-up period.

14.3.4 The functions and responsibilities assigned to the On-Site Section in the Operation Order were adequate for this series of tests and were well performed by the section.

14.4 OFF-SITE OPERATIONS

14.4.1 The personnel of the Off-Site Section indicated in Incl. 2, Chap. 1, of WT-702(REF.) carried out their responsibilities in an outstanding manner, and many valuable data on Off-Site fall-out were obtained. Much of this success was due to the capability of the Off-Site operations officer and his excellent knowledge of his work and of the country within the 200 mile area of responsibility. Both the military and PHS personnel were dependable and carried out responsible assignments.

14.4.2 The functioning and data collected by the Off-Site Section not only indicate the completeness in which the Off-Site work was done, but also on first analysis appear to indicate the needlessness of fixed air sampling stations for the Rad-Safe organization at the Nevada Proving Grounds. As indicated in Annex H to the Rad-Safe Operation Order, fixed air sampling stations were arranged peripherally around the test site. As no significant airborne activity levels were detected without significant ground readings from gamma survey instruments, it appears that unless external gamma radiation as registered by survey meters becomes dangerously high, there will be no hazard from airborne activity. It is recommended that for future operations, the air sampling program be eliminated as a responsibility of the Off-Site Operations Section with the exception of the two or three mobile air sampling teams that were used during the present operation. It is felt that if these mobile air sampling teams are moved so as to collect samples directly in the fall-out path, a complete enough coverage can be made of the airborne activity in that area. When the other monitoring teams, previously located at fixed air sampling stations, are relieved of this responsibility for air sampling, they will be more mobile; and it is conceivable that many of them can be moved from their initial station to the fall-out area. This will facilitate a more thorough coverage of the fall-out area.

14.4.3 For personnel for this section for future operations, it is necessary to consider that associated with the immediate Rad-Safe problem is also a very important public relations problem. The Off-Site monitor not only records and reports radiation in his sector, but often takes emergency action for the Test Manager. He must be able to converse with local officials for the Test Manager. He has been asked to investigate and review complaints registered by persons in the area, and in a few cases has been ordered to suggest that personnel in large communities go inside, as a precautionary measure. Only persons who are both levelheaded and experienced in the Rad-Safe problem can be expected to perform this type of duty satisfactorily. This becomes even more apparent when cognizance is given to the fact that the off-site monitor is often on his own, for communication with him, by either radio or telephone, is not dependable.

14.4.4 Most of the equipment for the Off-Site Section was furnished by H Division, LASL. This equipment functioned well for the program outlined.

14.4.5 The Off-Site Section needs additional office and working space. This should be considered prior to another operation. A quonset in the Mercury area would be a solution.

14.5 CONTROL SECTION

14.5.1 The responsibilities assigned to the Control Section in the Rad-Safe Operation Order were carried out well. The idea of this section and the data it presented to test personnel aided much in controlling the Rad-Safe operation.

14.5.2 One of the principal duties of the control officer was to control and assign missions to the aircraft used by the Rad-Safe Unit. Cloud tracking and the delineation of fall-out are two examples. These two functions are treated separately herein with recommendation for future air participation.

14.5.3 Support for the cloud-tracking mission was obtained from the 4925th Task Group (Atomic). They, in turn, obtained the aircraft and crews on a shot-to-shot, loan basis from the Strategic Air Command. Crews, to a large extent, were rotated to spread the training among

[redacted]

a greater number. This rotation diminished to some extent the efficiency of the cloud-tracking operation. This, in addition, required extra work on the part of permanent personnel in the form of continued briefings, etc. The aircraft commander in each case had performed the mission at least once before. This did not, however, always give a fully experienced commander in that his previous mission may have been either an air burst or a small tower shot, where little or no radiation was encountered at his altitude.

The method of tracking was designed to minimize the amount of radiation the crews were subjected to and at the same time define the limits of the cloud accurately. Errors in judgment of distance and speed, as well as in the time required for turn, in some cases brought the aircraft into high radiation fields. The aircraft, in some cases, became highly contaminated. However, basically, the method of tracking is sound, and no great improvements are suggested.

More continuity and stability can be obtained if the same crews fly this mission for each shot. If it is desired to train additional crews the extra crews should go along for the training and not to actually perform the mission. The crews chosen for the mission should arrive in sufficient time before the first shot to allow for a more adequate indoctrination training. This is desired in order to give the crews more knowledge of their mission and the hazards involved.

The problem of the proper altitudes and planes for cloud tracking should be considered. The position of the top of the cloud is easily determined by the sampler control aircraft, a B-50. The low level position of the stem of the cloud was covered by a B-25 at 12,000 ft. This is a desirable altitude as it assists greatly in approximating the position of the fall-out area. The position of the cloud from this low level altitude to the top of the cloud should be determined by one other aircraft, altitude depending upon the maximum height of the cloud. However, 25,000 to 30,000 ft msl is appropriate for clouds which do not rise higher than 45,000 ft msl. A B-29 was used for this intermediate altitude. A third aircraft would be needed in a reserve status to replace either of these two in case of mechanical failure, or to relieve either of the planes when it is necessary to track the cloud for an extended period. It is preferable that all three of these aircraft be of the same type, with the same altitude and range capabilities.

14.5.4 The terrain survey portion of air participation was divided into two separate functions, first, the close-in, or on-site, part which was performed by helicopter; and, second, the extended, or off-site, part which was performed by L-20 and C-47 type aircraft. Since there was some doubt as to the feasibility of delineation of the fall-out pattern by means of aircraft, preliminary fall-out plots for Shots Simon and Badger were made from air data alone. When these plots were later compared with the ground data from the Off-Site ground survey teams and data obtained by Program 27, it was observed that the correlation was excellent. However, there are several sources of errors, as might be expected in aerial surveys. In each case, action can be taken to minimize this error. One of the main errors is that of the determination, accurately, of the altitude above the terrain. An error of 100 or 200 ft from an altitude of 600 ft will produce a 50 per cent error. This error can be corrected, or eliminated, by the use of an accurately calibrated radio or radar altimeter. This type instrument is recommended as a requirement for the aircraft used on this type mission. Another error which is encountered in the terrain survey is in locating accurately the planes' positions. The maps used by the aircraft crews are 1:1,000,000 ratio aeronautical charts. These maps are known to be inaccurate as to terrain features. The scale of the map is not suitable for the pinpoint navigation necessary in this type survey. The new 1:250,000 aeronautical chart, when complete, would correct both of these faults. A final point of importance is the correlation of air to ground intensities. This is the determination of the ground intensity from the air intensity reading. To obviate this difficulty, several calibration flights were run during the current series of tests. The data are plotted from these calibration runs for a helicopter and a C-47 and are given in Incl. 2. As one would expect, correlation is different for different locations in the plane. Two separate curves are inclosed for the C-47. One is a correlation curve with the survey meter in the cockpit, and the other is with the meter in the cargo compartment. The source of radiation was

fall-out in the Yucca Flat area. This approximated an extended source as it covered at least two miles of fairly uniform contamination.

The T1B ion chamber instrument was found to be the most suitable survey meter for this type work. In the practical work at the Nevada Proving Grounds, detection of a ground contamination intensity of 10 mr/hr is an adequate lower limit. This would give an air reading at 500 ft above the ground of about 1 mr/hr. This intensity can be measured fairly accurately with the T1B field survey instrument. The more sensitive Geiger or scintillation type survey instruments seem to be of little advantage. In high fields, which are sometimes encountered, the MX-5 Geiger counter goes off scale, and the scintillation counter, the Scintelog obtained from NYOO, becomes so saturated that fast response at high intensity is not obtainable. At least two T1B's should be carried in the aircraft.

The C-1 air filter used on the C-47 was not of great value. The fall-out plot should be studied, and a sufficient delay in the take-off time should be made to assure that all fall-out has occurred and that no low contaminated patches of air remain in the valleys.

When fall-out has been heavy, an accurate survey can be made on D+1 day, and it is recommended that the terrain survey be repeated on this day. Little, if any, is gained by a 360° survey, however, as no evidence exists that a significant fall-out can occur up-wind.

The extended off-site portion of the survey, in this series, was made by an L-20 (out to about 30 miles) and by a C-47 from this range out to a distance of 200 miles. The C-47 does not have the desired performance for the mountainous terrain. A B-25 or a plane of the Convair 340 type would be more efficient.

14.5.5 The monitors functioning in the air participation worked directly under the Control Officer. This group should be organized as a separate, small section of the Rad-Safe Unit.

14.5.6 During this operation, the helicopter was not used to its maximum capability as the helicopters used for the first part of this series were old and unsuitable. An H-19, which arrived near the end of the series, was a more desirable type. In addition to survey work, the H-19 can be utilized in project recoveries in heavily contaminated areas. This would minimize exposure for project personnel and monitors. Three H-19's would be adequate to accomplish both these missions. In addition to the above, an H-19 can be used to transfer Off-Site personnel from one point to another in emergency situations.

14.6 LOGISTICS AND SUPPLY

14.6.1 Supply of equipment for the Rad-Safe Unit was satisfactory with the exception, as pointed out in the first chapter, that vehicles arrived late and therefore radio communications could not be properly checked out prior to start of the operation. Radio communication, both for On-Site and Off-Site, could not be depended upon at the beginning of the operation. Modification of the power supply, by the installation of separate 6-volt generators on the military vehicles after the second shot, and the installation of isoplane antennas on the On-Site $^{3}/_{4}$ ton vehicles after the fourth shot, improved On-Site communications considerably. The present radio communications for Off-Site, although much better than at the beginning of the operation, still cannot be depended upon.

14.6.2 There was a shortage of spare parts for the $^{1}/_{4}$-ton and $^{3}/_{4}$-ton military vehicles. This resulted in a hardship, as vehicles were sometimes deadlined when needed for operational work.

14.6.3 An additional laundry dryer is needed in the laundry room of the Rad-Safe Building to facilitate the processing of contaminated laundry. Although the washer is capable of processing laundry at a rate of 60 pounds per hour, the present dryer has a much lower capacity. This often caused a delay in the processing of contaminated clothing.

14.6.4 A modification of the basement of the Rad-Safe Building is in order. There is not enough working space for instrument repair personnel, instrument and battery storage, and Off-Site office and laboratory.

[redacted]

UNCLASSIFIED

14.6.5 The Logistics and Supply Section as organized for this operation functioned well.

14.7 RAD-SAFE SUPPORT UNIT

14.7.1 The idea of a Rad-Safe Support Unit has proved its value for this operation. The majority of the personnel of the Rad-Safe Unit for the operation were assigned to the 9778th Rad-Safe Support Unit. In addition to the operational functions already pointed out, the Commanding Officer, through his administrative section, handled all the Unit's administration and the assignment of personnel to various sections of the Rad-Safe Unit, as well as provided organized recreation for all troops of the Rad-Safe Unit. The Supply Section of the Support Unit formed the Logistics and Supply Section of the Rad-Safe Unit.

14.7.2 Most of the personnel of the Support Unit were well qualified for their work, and it is believed that with the experience gained from this operation in the requirements for a test operation, a permanent unit of this nature, preferably with many of the present personnel, could meet all but a few special requirements of a Rad-Safe operation at the Nevada Proving Grounds.

14.7.3 Assuming that a permanent unit is designed with the purpose of meeting all the requirements at the Nevada Proving Grounds, the following are considered as key positions and should be filled by personnel having training in nuclear physics and radiation health physics equivalent to that given to army officers with the 7330 MOS qualification:

1. Off-Site Operations Officer and assistant.
2. On-Site Operations Officer and assistant.
3. Control Officer.

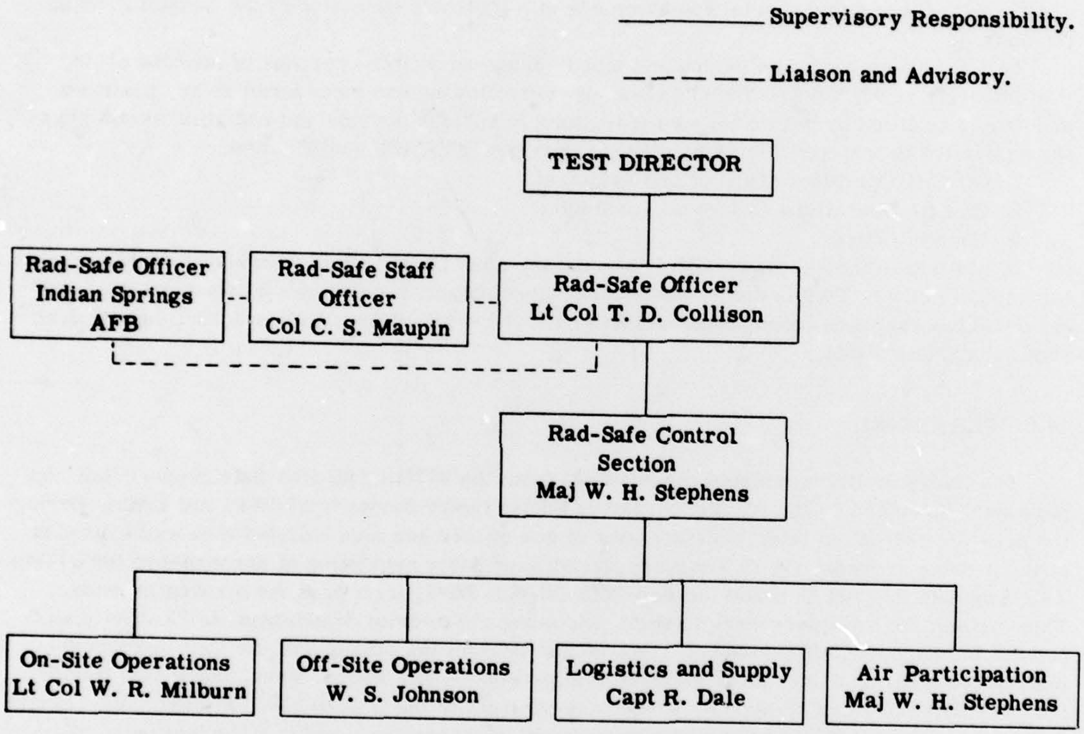
In addition to the above, all Off-Site monitors must be personnel with above average training and reliability. This is due to the unusual circumstances under which they must work and the decisions they must often make on their own. A review of the Off-Site activities with each shot substantiates this.

14.8 PERSONNEL

The Rad-Safe Unit consisted of personnel from the 9778th TSU Rad-Safe Support Unit and personnel furnished by the Air Force, Navy, Public Health Service, AFSWP, and LASL. During the pre-test period, an interim detachment of one officer and nine enlisted men was stationed at the proving grounds. On 15 February, an advance party consisting of personnel of the 9778th TSU Rad-Safe Support Unit and the Rad-Safe Officer, NPG, arrived at the proving grounds. This brought the total personnel strength, including the interim detachment, to 22. The main body of the Support Unit arrived on 1 March and brought the strength of the Unit to approximately 180 men. The arrival of augmentation personnel, Air Force, Navy, and Public Health Service, between 1 and 15 March, brought the strength of the Unit to 218, its maximum strength during the test period. Rotation and separation of personnel resulted in a fluctuation of the Unit's strength throughout the test period. However, the total strength of the Unit was steadily decreased after the ninth shot, as monitor personnel who had received their total permissible radiation dosage were returned to their home stations. On 6 June, the total number present was 98. By 15 June, the return of personnel had been completed with the exception of the three officers and the twenty enlisted men who were to remain during the interim period.

Inclosure 1

ORGANIZATION CHART

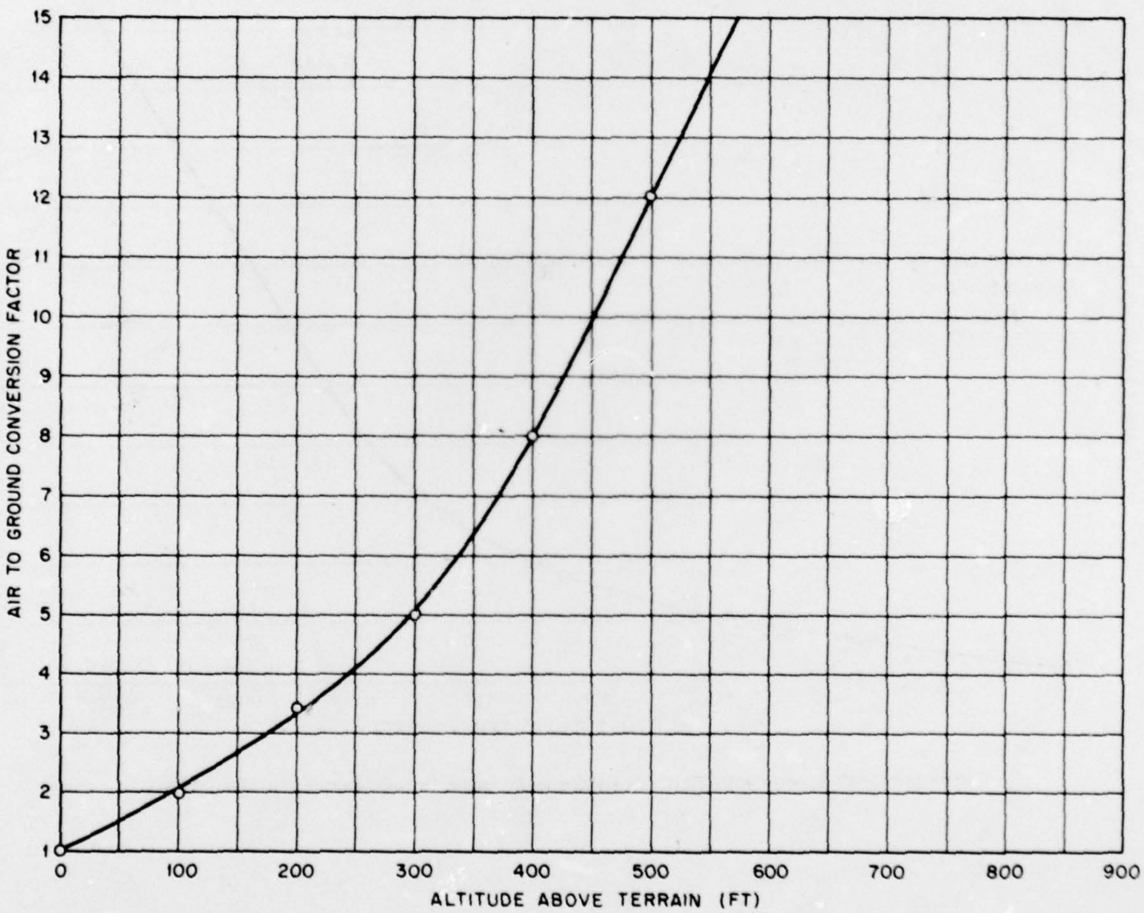


[redacted]

UNCLASSIFIED

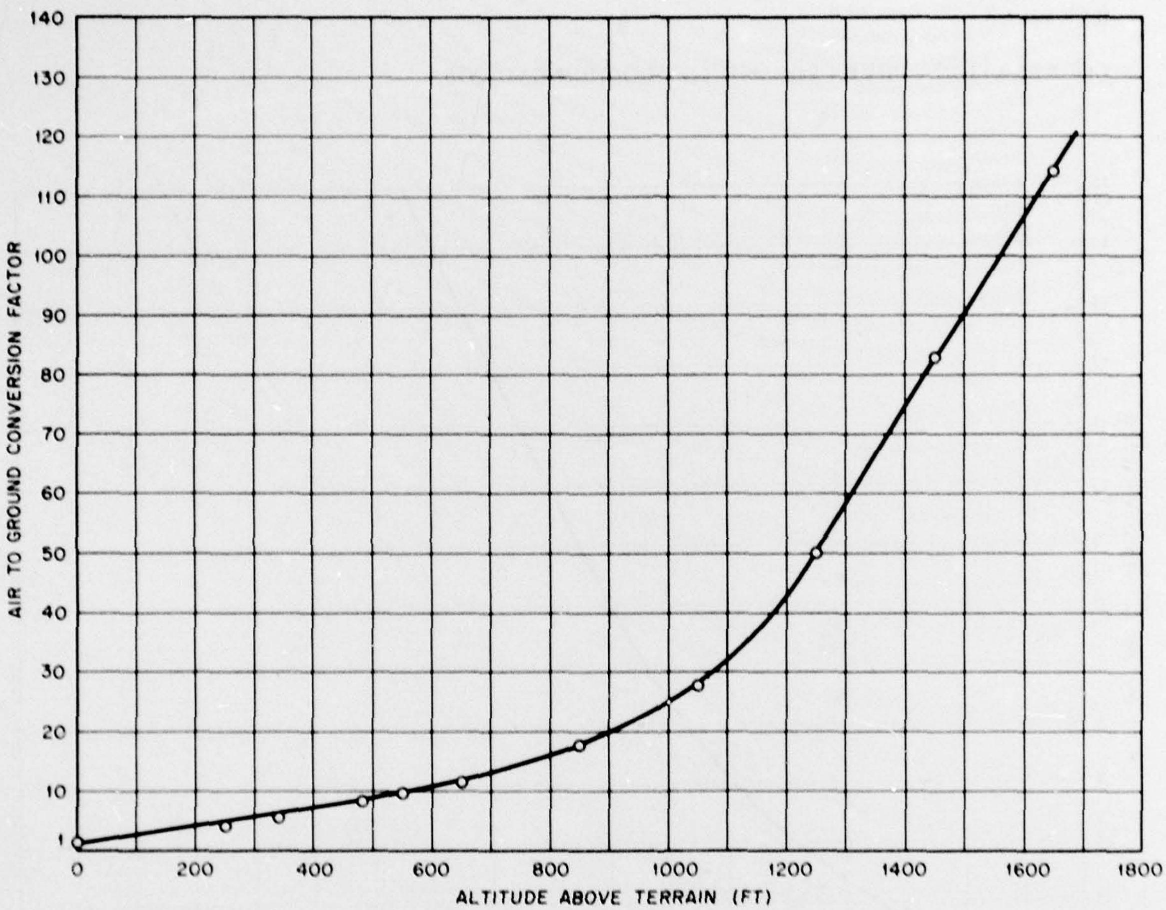
Inclosure 2

CORRELATION CURVES FOR AIR TO GROUND READINGS



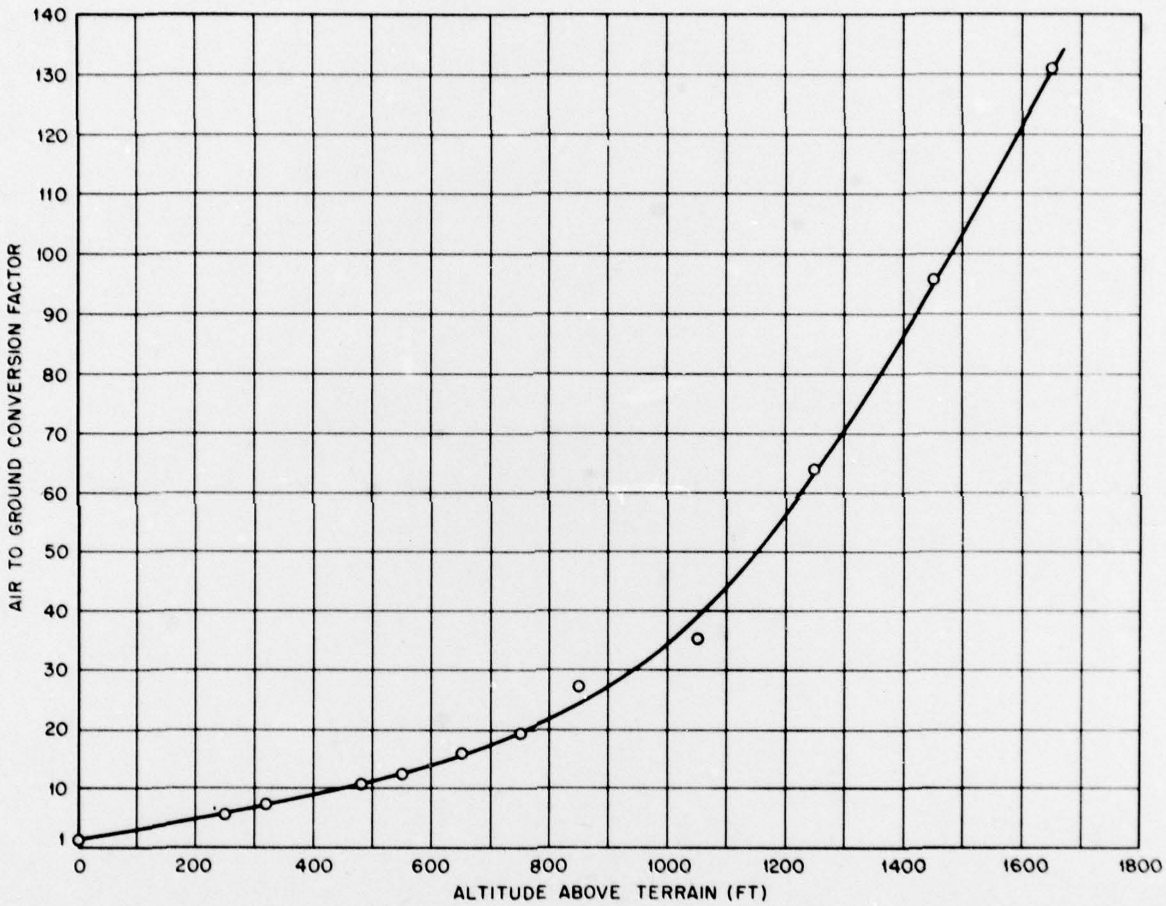
Correlation curve for readings taken over ground zero of Shot Annie 17 days (3 April 1953) after shot (helicopter survey with T1B).

[redacted]



Curve for C-47 survey with T1B. Readings were taken in the cockpit (19 April 1953).

[redacted]



Curve for C-47 survey with T1B. Readings were taken in the cargo compartment (19 April 1953).

[redacted]

UNCLASSIFIED

DISTRIBUTION

Military Distribution Category 5-70

ARMY ACTIVITIES

Asst. Chief of Staff, G-3, D/A, Washington 25, D. C., ATTN: Dep. CofS, G-3 (RR&SW)	1
Chief of Research and Development, D/A, Washington 25, D. C., ATTN: Special Weapons and Air Defense Division	2
Chief of Ordnance, D/A, Washington 25, D. C., ATTN: ORDTX-AR	3
Chief Signal Officer, D/A, P&O Division, Washington 25, D. C., ATTN: SIGOP	4-6
The Surgeon General, D/A, Washington 25, D. C., ATTN: Chief, R&D Division	7
Chief Chemical Officer, D/A, Washington 25, D. C.	8-9
The Quartermaster General, D/A, Washington 25, D. C., ATTN: Research and Development Division	10
Chief of Engineers, D/A, Washington 25, D. C., ATTN: ENGNB	11-14
Chief of Transportation, Military Planning and Intelligence Div., Washington 25, D. C.	15
Commanding General, Continental Army Command, Ft. Monroe, Va.	16-18
President, Board #1, Headquarters, Continental Army Command, Ft. Bragg, N. C.	19
President, Board #2, Headquarters, Continental Army Command, Ft. Knox, Ky.	20
President, Board #3, Headquarters, Continental Army Command, Ft. Benning, Ga.	21
President, Board #4, Headquarters, Continental Army Command, Ft. Bliss, Tex.	22
Commanding General, First Army, Governor's Island, New York 4, N. Y.	23
Commanding General, Second Army, Ft. George G. Meade, Md.	24
Commanding General, Third Army, Ft. McPherson, Ga., ATTN: ACofS, G-3	25
Commanding General, Fourth Army, Ft. Sam Houston, Tex., ATTN: G-3 Section	26
Commanding General, Fifth Army, 1660 E. Hyde Park Blvd., Chicago 15, Ill.	27
Commanding General, Sixth Army, Presidio of San Francisco, Calif., ATTN: AMGCT-4	28
Commanding General, U.S. Army Caribbean, Ft. Amador, C. Z., ATTN: Cml. Off.	29
Commanding General, USARFANT & MDPR, Ft. Brooke, Puerto Rico	30
Commanding General, U.S. Forces Austria, APO 168, c/o PM, New York, N. Y., ATTN: ACofS, G-3	31
Commander-in-Chief, Far East Command, APO 500, c/o PM, San Francisco, Calif., ATTN: ACofS, J-3	32-33
Commanding General, U.S. Army Forces Far East (Main), APO 343, c/o PM, San Francisco, Calif., ATTN: ACofS, G-3	34
Commanding General, U.S. Army Alaska, APO 942, c/o PM, Seattle, Wash.	35
Commanding General, U.S. Army Europe, APO 403, c/o PM, New York, N. Y., ATTN: OPOT Div., Combat Dev. Br.	36-37
Commanding General, U.S. Army Pacific, APO 958, c/o PM, San Francisco, Calif., ATTN: Cml. Off.	38-39
Commandant, Command and General Staff College, Ft. Leavenworth, Kan., ATTN: ALLLS(AS)	40
Commandant, Army War College, Carlisle Barracks, Pa., ATTN: Library	41
Commandant, The Artillery and Guided Missile School, Ft. Sill, Okla.	42
Secretary, The Antiaircraft Artillery and Guided Missile School, Ft. Bliss, Tex., ATTN: Maj. George L. Alexander, Dept. of Tactics and Combined Arms	43
Commanding General, Medical Field Service School, Brooke Army Medical Center, Ft. Sam Houston, Tex.	44

[redacted]

UNCLASSIFIED

Director, Special Weapons Development Office, Headquarters, CONARC, Ft. Bliss, Tex., ATTN: Lt. Arthur Jaskierny	45
Commandant, Army Medical Service Graduate School, Walter Reed Army Medical Center, Washington 25, D. C.	46
Superintendent, U.S. Military Academy, West Point, N. Y., ATTN: Prof. of Ordnance	47
Commandant, Chemical Corps School, Chemical Corps Training Command, Ft. McClellan, Ala.	48
Commanding General, Research and Engineering Command, Army Chemical Center, Md., ATTN: Deputy for RW and Non-Toxic Material	49-50
Commanding General, The Engineer Center, Ft. Belvoir, Va., ATTN: Asst. Commandant, Engineer School	51-53
Commanding Officer, Engineer Research and Development Laboratory, Ft. Belvoir, Va., ATTN: Chief, Technical Intelligence Branch	54
Commanding Officer, Picatinny Arsenal, Dover, N. J., ATTN: ORDBB-TK	55
Commanding Officer, Army Medical Research Laboratory, Ft. Knox, Ky.	56
Commanding Officer, Chemical Corps Chemical and Radiological Laboratory, Army Chemical Center, Md., ATTN: Tech. Library	57-58
Commanding Officer, Transportation R&D Station, Ft. Eustis, Va.	59
Commandant, The Transportation School, Ft. Eustis, Va., ATTN: Security and Information Officer	60
Director, Technical Documents Center, Evans Signal Laboratory, Belmar, N. J.	61
Director, Waterways Experiment Station, PO Box 631, Vicksburg, Miss., ATTN: Library	62
Director, Operations Research Office, Johns Hopkins University, 7100 Connecticut Ave., Chevy Chase, Md., Washington 15, D. C.	63
Commanding General, Quartermaster Research and Development Command, Quartermaster Research and Development Center, Natick, Mass., ATTN: CBR Liaison Officer	64-65
Technical Information Service, Oak Ridge, Tenn. (surplus)	66-72

NAVY ACTIVITIES

Chief of Naval Operations, D/N, Washington 25, D. C., ATTN: OP-36	73-74
Chief of Naval Operations, D/N, Washington 25, D. C., ATTN: OP-03EG	75
Director of Naval Intelligence, D/N, Washington 25, D. C., ATTN: OP-922V	76
Chief, Bureau of Medicine and Surgery, D/N, Washington 25, D. C., ATTN: Special Weapons Defense Div.	77
Chief, Bureau of Ordnance, D/N, Washington 25, D. C.	78
Chief of Naval Personnel, D/N, Washington 25, D. C.	79
Chief, Bureau of Ships, D/N, Washington 25, D. C., ATTN: Code 348	80-81
Chief, Bureau of Yards and Docks, D/N, Washington 25, D. C., ATTN: D-440	82
Chief, Bureau of Supplies and Accounts, D/N, Washington 25, D. C.	83
Chief, Bureau of Aeronautics, D/N, Washington 25, D. C.	84-85
Commander-in-Chief, U.S. Pacific Fleet, Fleet Post Office, San Francisco, Calif.	86
Commander-in-Chief, U.S. Atlantic Fleet, U.S. Naval Base, Norfolk 11, Va.	87
Commandant, U.S. Marine Corps, Washington 25, D. C., ATTN: Code A03H	88-91
President, U.S. Naval War College, Newport, R. I.	92
Superintendent, U.S. Naval Postgraduate School, Monterey, Calif.	93
Commanding Officer, U.S. Naval Schools Command, U.S. Naval Station, Treasure Island, San Francisco, Calif.	94
Commanding Officer, U.S. Fleet Training Center, Naval Base, Norfolk 11, Va., ATTN: Special Weapons School	95
Commanding Officer, U.S. Fleet Training Center, Naval Station, San Diego 36, Calif., ATTN: (SPWP School)	96
Commanding Officer, U.S. Naval Damage Control Training Center, Naval Base, Philadelphia 12, Pa., ATTN: ABC Defense Course	97
Commanding Officer, U.S. Naval Unit, Chemical Corps School, Army Chemical Training Center, Ft. McClellan, Ala.	98
Commander, U.S. Naval Ordnance Laboratory, Silver Spring 19, Md., ATTN: R	99
Commander, U.S. Naval Ordnance Test Station, Inyokern, China Lake, Calif.	100
Officer-in-Charge, U.S. Naval Civil Engineering Res. and Evaluation Lab., U.S. Naval Construction Battalion Center, Port Hueneme, Calif., ATTN: Code 753	101

[redacted]

UNCLASSIFIED

Commanding Officer, U.S. Naval Medical Research Inst., National Naval Medical Center, Bethesda 14, Md.	102
Director, U.S. Naval Research Laboratory, Washington 25, D. C., ATTN: Code 2029	103
Director, The Material Laboratory, New York Naval Shipyard, Brooklyn, N. Y.	104
Commanding Officer and Director, U.S. Navy Electronics Laboratory, San Diego 52, Calif., ATTN: Code 4223	105
Commanding Officer, U.S. Naval Radiological Defense Laboratory, San Francisco 24, Calif., ATTN: Technical Information Division	106–109
Commanding Officer and Director, David W. Taylor Model Basin, Washington 7, D. C., ATTN: Library	110
Commanding Officer, U.S. Naval Photographic Center, Anacostia, D. C.	111–112
Commander, U.S. Naval Air Development Center, Johnsville, Pa.	113
Director, Office of Naval Research Branch Office, 1000 Geary St., San Francisco, Calif.	114
Commanding Officer, Clothing Supply Office, Code 1D-0, 3rd Avenue and 29th St., Brooklyn, N. Y.	115
Commandant, U.S. Coast Guard, 1300 E. St. N.W., Washington 25, D. C., ATTN: Capt. J. R. Stewart	116
Technical Information Service, Oak Ridge, Tenn. (surplus)	117–123

AIR FORCE ACTIVITIES

Asst. for Atomic Energy, Headquarters, USAF, Washington 25, D. C., ATTN: DCS/O	124
Director of Operations, Headquarters, USAF, Washington 25, D. C., ATTN: Operations Analysis	125
Director of Plans, Headquarters, USAF, Washington 25, D. C., ATTN: War Plans Div.	126
Director of Research and Development, Headquarters, USAF, Washington 25, D. C., ATTN: Combat Components Div.	127
Director of Intelligence, Headquarters, USAF, Washington 25, D. C., ATTN: AFOIN-IB2	128–129
The Surgeon General, Headquarters, USAF, Washington 25, D. C., ATTN: Bio. Def. Br., Pre. Med. Div.	130
Deputy Chief of Staff, Intelligence, Headquarters, U.S. Air Forces Europe, APO 633, c/o PM, New York, N. Y., ATTN: Directorate of Air Targets	131
Commander, 497th Reconnaissance Technical Squadron (Augmented), APO 633, c/o PM, New York, N. Y.	132
Commander, Far East Air Forces, APO 925, c/o PM, San Francisco, Calif.	133
Commander-in-Chief, Strategic Air Command, Offutt Air Force Base, Omaha, Nebr., ATTN: Special Weapons Branch, Inspector Div., Inspector General	134
Commander, Tactical Air Command, Langley AFB, Va., ATTN: Documents Security Branch	135
Commander, Air Defense Command, Ent AFB, Colo.	136
Commander, Wright Air Development Center, Wright-Patterson AFB, Dayton, O., ATTN: WCRRN, Blast Effects Research	137–138
Commander, Air Training Command, Scott AFB, Belleville, Ill., ATTN: DCS/O GTP	139
Assistant Chief of Staff, Installations, Headquarters, USAF, Washington 25, D. C., ATTN: AFCIE-E	140
Commander, Air Research and Development Command, PO Box 1395, Baltimore, Md., ATTN: RDDN	141
Commander, Air Proving Ground Command, Eglin AFB, Fla., ATTN: AG/TRB	142
Director, Air University Library, Maxwell AFB, Ala.	143–144
Commander, Flying Training Air Force, Waco, Tex., ATTN: Director of Observer Training	145–152
Commander, Crew Training Air Force, Randolph Field, Tex., ATTN: 2GTS, DCS/O	153
Commander, Headquarters, Technical Training Air Force, Gulfport, Miss., ATTN: TA&D	154
Commandant, Air Force School of Aviation Medicine, Randolph AFB, Tex.	155–156
Commander, Wright Air Development Center, Wright-Patterson AFB, Dayton, O., ATTN: WCOSI	157–159
Commander, Air Force Cambridge Research Center, LG Hanscom Field, Bedford, Mass., ATTN: CRQST-2	160–161
Commander, Air Force Special Weapons Center, Kirtland AFB, N. Mex., ATTN: Library	162–164

[redacted]

UNCLASSIFIED

Commandant, USAF Institute of Technology, Wright-Patterson AFB, Dayton, O., ATTN: Resident College	165
Commander, Lowry AFB, Denver, Colo., ATTN: Department of Armament Training	166
Commander, 1009th Special Weapons Squadron, Headquarters, USAF, Washington 25, D. C.	167
The RAND Corporation, 1700 Main Street, Santa Monica, Calif., ATTN: Nuclear Energy Division	168–169
Commander, Second Air Force, Barksdale AFB, Louisiana, ATTN: Operations Analysis Office	170
Commander, Eighth Air Force, Westover AFB, Mass., ATTN: Operations Analysis Office	171
Commander, Fifteenth Air Force, March AFB, Calif., ATTN: Operations Analysis Office	172
Technical Information Service, Oak Ridge, Tenn. (surplus)	173–179

OTHER DEPARTMENT OF DEFENSE ACTIVITIES

Asst. Secretary of Defense, Research and Development, D/D, Washington 25, D. C., ATTN: Tech. Library	180
U.S. Documents Officer, Office of the U.S. National Military Representative, SHAPE, APO 55, New York, N. Y.	181
Director, Weapons Systems Evaluation Group, OSD, Rm 2E1006, Pentagon, Washington 25, D. C.	182
Commandant, Armed Forces Staff College, Norfolk 11, Va., ATTN: Secretary	183
Commanding General, Field Command, Armed Forces Special Weapons Project, PO Box 5100, Albuquerque, N. Mex.	184–189
Commanding General, Field Command, Armed Forces, Special Weapons Project, PO Box 5100, Albuquerque, N. Mex., ATTN: Technical Training Group	190–191
Chief, Armed Forces Special Weapons Project, Washington 25, D. C., ATTN: Documents Library Branch	192–200
Commanding General, Military District of Washington, Room 1543, Building T-7, Gravelly Point, Va.	201
Technical Information Service, Oak Ridge, Tenn. (surplus)	202–208

ATOMIC ENERGY COMMISSION ACTIVITIES

U.S. Atomic Energy Commission, Classified Technical Library, 1901 Constitution Ave., Washington 25, D. C., ATTN: Mrs. J. M. O'Leary (for DMA)	209–211
Los Alamos Scientific Laboratory, Report Library, PO Box 1663, Los Alamos, N. Mex., ATTN: Helen Redman	212–213
Sandia Corporation, Classified Document Division, Sandia Base, Albuquerque, N. Mex., ATTN: Martin Lucero	214–218
University of California Radiation Laboratory, PO Box 808, Livermore, Calif., ATTN: Margaret Edlund	219–221
Weapon Data Section, Technical Information Service, Oak Ridge, Tenn.	222
Technical Information Service, Oak Ridge, Tenn. (surplus)	223–235

AEC, Oak Ridge, Tenn.